THE

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ELECTRICAL REVIEW.

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THE SALE OF WIRELESS APPARATUS.

THE great success of the broadcasting of opera from Covent Garden has acted as a further stimulant to the interest taken in "wireless" by the general public, and it is reasonable to expect a corresponding increase in the sale of "listening-in" sets. On the other hand, it is doubtful whether the electrical trade generally, and electrical contractors in particular, are likely to derive a great deal of benefit from this under existing conditions. One hears complaints that the makers of radio apparatus have not dealt kindly with electrical contractors; many of them sell their goods retail direct to the user, they give full trade discounts to motor garages and toy shops, and additional preferential discounts to large departmental stores. The electrical contractor has felt that no encouragement has been given him to interest himself in this new development of the electrical industry, and has in many cases left it severely alone up to the present.

But has the electrical contractor looked at the matter from the manufacturer's point of view? A manufacturer must find a market for his goods; he must either be his own salesman or find firms which are in a position to act for him in this capacity. Has the electrical contractor taken the trouble to learn the technical rudiments of wireless reception, or to purchase apparatus either for stock or for his own instruction? Is he familiar with the constituent parts of a wireless receiving set and its accessories, and in a position to advise customers in the selection of these or to connect them up and "tune in" for him? Firms such as Selfridge's, Harrod's, and Gamage's started their wireless departments last summer in anticipation of the boom, engaged technical assistants and good salesmen who could not only demonstrate the apparatus in use, but could tell their customers how to connect it and use it, and have sold thousands of pounds' worth of receiving instruments. To extend their market and to recoup themselves for their heavy initial expenditure in perfecting their design, manufacturers have had to advertise to the users, through the daily Press, the popular wireless periodicals that have sprung up, and last, but certainly not least, by the successful operations of the British Broadcasting Co., and can hardly be blamed if they accept direct orders which ensue. They have a right to argue that trade discount is payment for the cost of finding the customer, and that if they incur the expense of doing this, they would be foolish to refuse an order and forgo the profit which the retailer has not earned. Again, the garage proprietors, realising that there was a good potential revenue in charging accumulators for wireless sets at the same time as ignition batteries, interested themselves in the sale of the sets as well. From the manufacturers' point of view, the garage which pours out a blast of broadcast news and music from a loud speaker in its showroom every night earns the trade discount better than an electrical contractor, whose showroom is not similarly equipped.

The manufacturer of wireless apparatus deserves every encouragement; under the terms of the agreement between the Post Office and the British Broadcasting Co. he has only about two years in which to establish his products to withstand the onslaughts of foreign competition. The Broadcasting Co. has opened up an enormous new field for development in the electrical industry, and

the electrical contractor will be shortsighted indeed if he does not embark in it to the fullest extent within his power. Only by so doing will he establish his claim to preferential terms; he has indeed a *prima facie* right to a special discount, but he must justify it by producing results. In this connection a word of warning is necessary. In house wiring, each contractor finds it advantageous to standardise his practice as far as possible. Quality being equal, it is more or less immaterial to his customer what make of cable, conduit, fittings, or accessories is used, and the contractor selects his manufacturer for each line and derives such additional profit as he can from quantity buying. With radio receiving sets, the position is by no means similar. There is even more variation in tone, method of manipulation, and results between different makes, combinations of valves, and arrangements of circuits than there is between different makes of pianos or motor-cars. Discriminating purchasers will desire to select from several different makes and patterns, and those who leave it to the discretion of their electrical contractor will expect him to know from actual knowledge and experience which set will be most suitable for their requirements and the particular position and circumstances in which it is to be used. Hence a contractor taking up the wireless business for the first time would do well to obtain the advice and guidance of an expert before laying in a stock of apparatus. The set purchasable on the best terms or the best discount, while not necessarily giving the worst results or the coarsest reproduction of music, can certainly not be relied upon as a stock article to suit every man's taste.

A few words may be added regarding the reception of the extracts from the Covent Garden opera last week. The signal strength was greater than the average of the Marconi House concerts, and the transmission was so good that it could be heard and enjoyed on a crystal set with two or more head 'phones anywhere in the neighbourhood of London or the surrounding suburbs. Several long-distance receptions from various parts of England and Scotland were also reported. For full appreciation of the tone and quality of the music at a radius of 10 or 15 miles and upwards, valve sets were, of course, preferable, and it was interesting to note the great improvement in quality obtainable with high-frequency amplification as compared with low frequency. Those who were not afraid of the more difficult and delicate adjustment of the high-frequency transformer circuits found that the use of two stages of high-frequency amplification in front of the detector gave absolutely perfect music, and that amplification on the low-frequency side, although very effective for those desiring additional volume of sound, was preferably dispensed with unless necessary for the use of a loud speaker. The use of reactance in any degree at all (whether reacting directly on the aerial or on the h.f. transformer) was unnecessary, and better purity of tone was obtained without it. It is satisfactory to note that disturbances from the use of reactance by listeners-in were generally absent or insignificant. A correspondent who listened to the whole of the "Pagliacci" on a circuit with two accurately-tuned h.f. valve circuits and a detector without reactance, at thirteen or fourteen miles from Marconi House on Wednesday last week, informs us emphatically that he never heard a better rendering of the opera.

Points for Electrical Salesmen.

THE first lecture of the New Year in the series of Salesmanship Conferences organised by the Electrical Development Association was given by Mr. Beauchamp on January 5th, and is reported on another page; it probably contained—as perhaps it should, coming as it did from the Director of the Association—more selling points and advice to the electrical salesman than all the previous lectures put together. That is not in any way derogatory to the previous lecturers, because they have all dealt with particular aspects in a particular way. The *raison d'etre* of the lecture was to give some advice to the salesman on dealing with arguments from the other side, and the advice given was extremely valuable. At the same time, a wise warning was uttered by Mr. E. T. Ruthven-Murray, of the North Metropolitan Electric Power Co., not to proceed too much on the line of "slanging" one's opponent. Mr. Beauchamp rightly disclaimed any attempt to rely on slanging the other side, and although at times the gas industry, equally with the electrical industry, is bound to find itself making comparisons between the two forms of light, heat and power, yet it was some years ago that the gas industry definitely appreciated the fact that the adoption of a policy of little else than continually deriding its competitor, electricity, might easily do more harm than good to the gas industry. After all, even a so-called British public is able to discriminate, and there is the danger that a prospective customer might actually be driven by these arguments to assume that electricity must be a poor sort of thing if the main selling point is to belittle gas. There are so many inherent advantages in the use of electricity for all purposes that the salesman will find his time fully occupied in expounding these, always having in reserve, of course, the other side of the case put forward by the advocates of gas or other fuel, if compelled to meet it by the prospective customer.

One of the most important points mentioned by Mr. Beauchamp was prevention of the use of apparatus in inappropriate circumstances. He instanced the use of electric heaters continually in a living room. There are many others, and certainly electric lighting was not served a good turn when the half-watt lamp first came in, because many ignorant householders, unaware of the high candle power of the original lamps, put them into small living rooms. The result was that they got much more light than was necessary and a much larger bill at the end of the quarter than was good for their peace of mind. They promptly took out the new lamps and were probably chary of trying later developments which really suited their purpose. There were such a number of selling points in Mr. Beauchamp's lecture that it has been impossible to refer to them all in our report. The lecture constitutes a part of the propaganda work of the Association, and as such will no doubt be issued in pamphlet form later. All interested in the sale of electricity and apparatus should read it *in extenso* when they get the opportunity.

The Electrification of Russia.

CONDITIONS in Russia following upon the changes effected by the Bolshevists have been wrapped in a robe of mystery, and reports have presented widely differing pictures depending upon the sympathy or antipathy shown by the observer towards the new *régime*. Now, however, more reliable information is becoming available owing to the relaxing of the rigid secrecy and suspicion which for a long time characterised the action of Russia's new rulers. We were enabled a few weeks ago to publish some details of the Kaschirsk (Kashira) station, which has been erected to supply power to Moscow at a pressure of 115,000 volts (ELEC. REV., December 15th, p. 898).

In the present issue we publish a review of electrical activities within recent months, and in prospect, from which it will be gathered that a real effort is being made to revivify the industry of the country and to restore Russia to something like her previous greatness. A single directing authority has been formed to take the place of the two which had hitherto been functioning, leading to much overlapping. This body, the "Glavelektro," will control all public undertakings except those serving purely Governmental purposes. The largest single undertaking planned is the station (200,000 kW) to utilise the waters of the Volchoff. A big effort is being made to secure a part of the order for the generators to the Russian factories, but here the

question of ability to do the work in a reasonable time is involved.

Another feature of the developments recorded is the use of the low-grade fuels of the Moscow basin and adjacent districts. It is announced that excellent results have been obtained by the use of specially-designed apparatus—a figure of 1.7 kilogrammes per kilowatt-hour being mentioned. This is, of course, indefinite in the absence of any information regarding the calorific value of the fuel, but the average normal consumption is given as 2.5 kilogrammes.

In our article it is emphasised that the Moscow developments must not be taken as a certain indication of Russian progress as a whole, but it may be assumed that the Soviet Government will be compelled to proceed in the same way in the other important industrial areas.

Very little definite information can be gained regarding the electrical industry generally, but it appears that steps are being taken to put the lamp manufacturing industry on a sound basis. While Germany seems to be the most-favoured foreign country in respect of orders for plant, there appears to be ample opportunity for the participation of others in the re-establishment of Russian industry and social life.

Transatlantic Telephony.

The valuable and interesting tests, which have been in progress for some time and will probably extend over several months, undertaken in this country by the International Western Electric Co., Inc., and the Western Electric Co., Ltd., in co-operation with the American Telephone and Telegraph Co. and the Radio Corporation of America, with the object of determining the feasibility of commercial transatlantic radio telephony were brought before the notice of the public on Monday last by the demonstration described elsewhere in this issue.

This unique achievement reflects the greatest possible credit on all who contributed towards its success, especially so when the short time in which the demonstration was arranged is taken into account. The conditions under which the transmitting and receiving apparatus functioned were admittedly experimental, and the atmospheric state was no more favourable than is ordinarily to be expected at this time of the year, so that the results should stimulate confidence in what is to be expected in the future. The fact that the demonstration took place at night, the most favourable time, should not be made too much of, because hitherto no such performance has been carried out "according to programme" without a hitch and some element of chance.

Monday morning's feat cannot be described as a freak, so that the question naturally arises as to the possibility of commercial radio-telephony over great distances, and particularly across the Atlantic and Pacific Oceans, in which cases it is physically impossible to telephone by any other than radio means.

All the engineering features involved in the establishment of commercial radio-telephone communication between the two countries are not yet known, so that no definite statements can be made concerning the prospects for transatlantic radio-telephone service. It is hoped that the tests which are now being made will furnish engineering information leading to a more complete knowledge of the economic and other factors involved in such a service. The art of connecting wire and radio systems to one another to form a single unit has been developed until no difficulties are encountered now. The radio transmitter on Long Island is connected by wire telephone lines to New York, 70 miles away, and may be connected through ordinary telephone switchboards to any point in the United States. It would be possible, if a transatlantic service existed, for any subscriber in the Bell telephone system to speak to Europe through Rocky Point in exactly the same way as he carries on an ordinary conversation. There are many occasions on which large sums of money would gladly be paid for a few minutes' conversation, and, moreover, such a long-distance radio "circuit" need not be confined exclusively to telephony. If it were used as a high-speed multiplex telegraph circuit as well, the latter service would probably cover the operating expenses involved, and thus the telephone revenue could be regarded mainly as profit.

British Opportunities in Western Canada.

Though we have lately devoted a good deal of space to Canada as a market considered from the purely electrical standpoint, the subject, as well as the area and the possibilities, is so vast that the matter is far from exhausted. In the opinion of Mr. G. T. Milne it is no fault of the consumer that the United Kingdom does not enjoy a larger share of the trade of Western Canada. Mr. Milne is the retiring Senior Trade Commissioner in Canada, and his report, to which reference appears on another page, should be studied by all those who recognise that the opportunities for the sale of British exports are much greater within our own Empire than in any other part of the world. We are glad to think that recognition of this fact, which we have kept steadily before our readers, is growing amongst United Kingdom manufacturers and merchants. However difficult it is for British electrical engineers to compete successfully in those parts of the Dominion where United States and locally-made articles are strongly entrenched, the vastness of the Canadian field demands that no effort should be spared to cultivate the market wherever a chance of obtaining a footing presents itself.

The greater portion of the period which Mr. Milne reviews was one of depression. But before he closed his report he was able to record that the worst was felt to be over, and the outlook more hopeful. "It is generally conceded (he says) that there will be steady improvement provided that the grain crops are satisfactory." This improvement should now be within measurable distance of full realisation in view of the very large surplus of grain that is known to be available. In these circumstances there is special point in the three illustrations which Mr. Milne gives of the opportunity for the expansion of United Kingdom trade in manufactured products with Western Canada. He draws attention to the important facts that—

(1) Canadian exports of grains and milled products to the United Kingdom in 1921 amounted to $175,000,000.

(2) Western Canada furnishes 77 per cent. of the entire grain crop of Canada.

(3) The total value of all imports from the United Kingdom in 1921 amounted to $117,000,000.

A fourth important consideration which has arisen more recently is the Fordney-McCumber tariff. Owing to the restrictive import duties which this piece of legislation places upon many Canadian products, there is little doubt, as has been stated already, that the Dominion buyer will look to a country where less one-sided views of business prevail.

German Electrical Millions.

Statistics have been issued in Germany concerning the capital augmentations which took place in 1922 in order to deal with the situation caused by the restriction of credits and the depreciation of the mark. Figures are given for different industries, and electrical and gas undertakings are comprised in one group in millions of marks. The nominal increases in this group amounted to 1,004 millions of marks in 1920, 1,995 millions in 1921, and 4,776 millions in 1922. In the case of new companies in the electrical and gas group, the share capital of the new undertakings formed in 1920 was 79 millions of marks; in 1921 it reached 1,709 millions; and in 1922, 386 millions. The loans of those new companies bearing a fixed rate of interest rose from 476 millions in 1920 to 2,368 millions in 1921 and 6,097 millions of marks in 1922. All these figures are nominal, and most of those which concern the electrical industry apply to electricity supply schemes promoted both by local and other authorities in conjunction with private enterprise.

THE OUT-DOOR SUB-STATION "HAUTERIVE."

A Swiss Installation.

PERHAPS no other country on the Continent of Europe is at present so intensely occupied with electrification in every possible direction as the Swiss Republic. Such development has during recent years set the Entreprises Electriques Fribourgeoises, in the western part of Switzerland, the problem of extending its generating plant, and at the beginning of 1920 the building of the new power house "La Jogne," near Broc, in the Gruyère mountains, was energetically pushed ahead with such speed that in the autumn of the same year the first generating set was put to work. Electricity is generated at 8,600 volts, the power house being designed ultimately to house five generators each of 5,300 kVA, 8,600 volts, 50 cycles, three-phase, representing a total of 26,500 kVA normal generator capacity. The machines are connected either to 8,600-volt auxiliary busbars or direct through a 5,500-kVA, three-phase transformer, connected on the h.p. side either in delta or in star, thus producing the pressures of 36,000 and 62,500 volts.

The distribution is carried out by means of six outgoing overhead feeders, *i.e.*, four feeders at 36,000 volts of 6,250 kVA each, and two at 62,500 volts of 12,500 kVA each. In large undertakings the rational co-operation of the entire generating plant is of prime importance, and the company had to use one of the outgoing 62,500-volt lines as an interconnection between the two power stations Hauterive-Fribourg and La Jogne-Broc (fig. 1). This linking station had to be built with the minimum capital outlay, and therefore the layout and tender submitted by the Sprecher & Schuh Co., of Aarau, Switzerland, for an outdoor station on a site beside the existing switch-house at Hauterive, which forms at the same time an extension of the existing power station "Hauterive," was accepted.

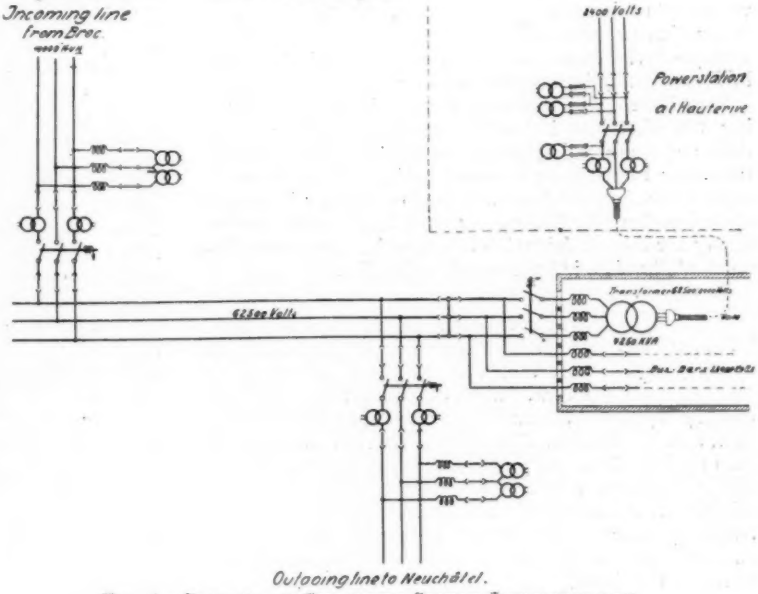


FIG. 1.—DIAGRAM OF GENERATING STATION INTERCONNECTION.

The pressure at the generator terminals at Hauterive is 8,400 volts, and step-up transformers raise it to 32,000 volts for the outgoing overhead lines. The link with the 62,500-volt feeder from Broc is established through a further step-up 4,250-kVA transformer at 32,000/62,500 volts, located in the existing building, the option of using which either at 32,000 or 62,500 volts enables energy to be supplied in either direction,

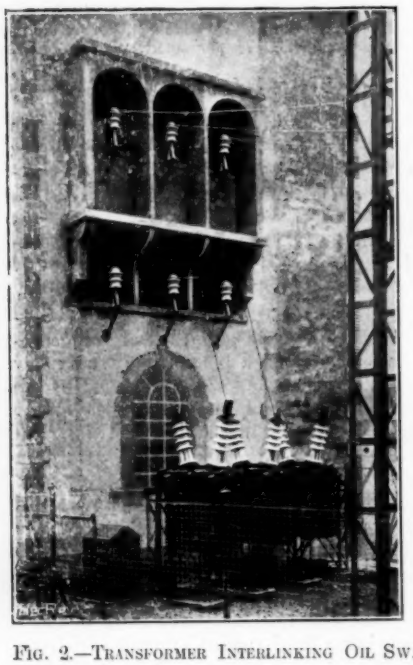


FIG. 2.—TRANSFORMER INTERLINKING OIL SWITCH.

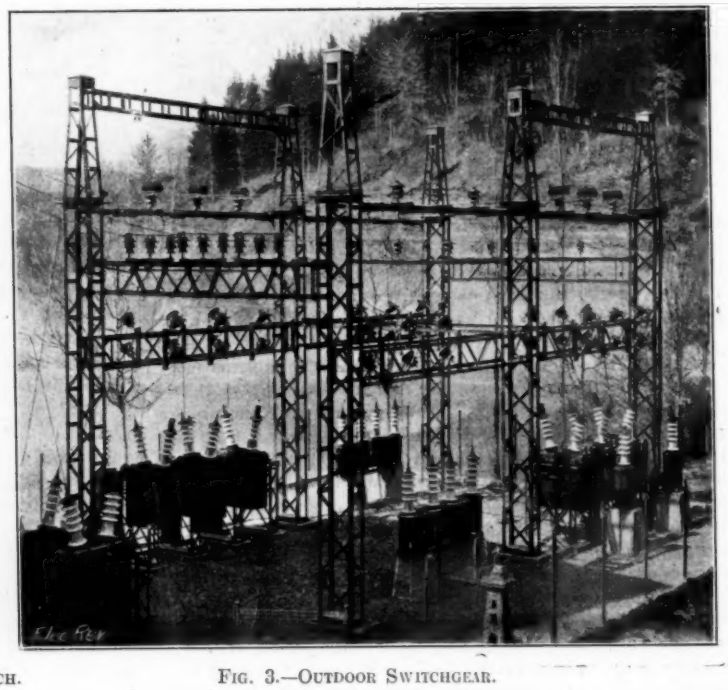


FIG. 3.—OUTDOOR SWITCHGEAR.

i.e., from Hauterive through the transformer, or to the 62,500-volt network, or at 32,000 volts direct from Broc to the 32,000-volt busbars in the switch-house at Hauterive and thence on to the 32,000-volt lines. The method of effecting this connection and the position of the transformer oil switch are represented by fig. 2.

The lay-out of the switchgear corresponds exactly to the diagram in fig. 1. Provision is made for an incoming 10,000-kVA, 62,500/32,000-volt line from Broc, one set of three-phase busbars, one outgoing 62,500-volt line to Neuchatel, and one branch to the transformer

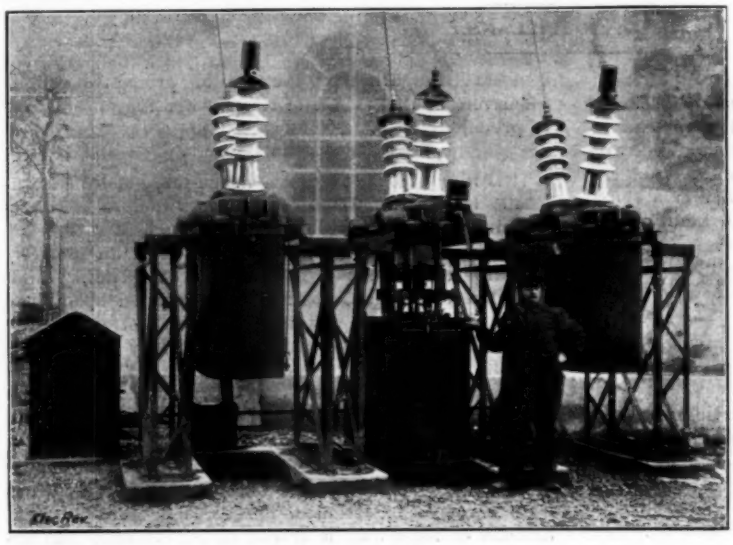


FIG. 4.—OIL SWITCH.

and the 32,000-volt busbars in the switch-house at Hauterive. From fig. 3 it will be seen how closely the actual lay-out follows the diagram.

In the right-hand corner is the switch group of the incoming line, together with the current transformers for the instruments; the two single-phase potential transformers are to the left of the oil switch. The apparatus for the outgoing line to Neuchatel is arranged in an identical manner. Isolating switches, choke-coils, and busbars are placed on the structure above the oil switches. The incoming overhead line is fixed to strain-insulators and then passes through isolating switches, current transformers, and oil switches to the busbars. In a branch to this main connection are the potential transformers. Choke-coils of an inductance of 0.1 mH are placed between the busbars and the shunt transformers. The outgoing line is an exact duplicate of the incoming feeder.

In the longitudinal direction of the busbars and as a continuation of them will be found the connection to the existing 32,000-volt switch-house. To effect a complete separation between the latter and the outdoor station, an isolating switch with horizontally-swivelling blades is fixed on the structure and operated as a three-pole combination by means of a common operating lever. The arrangement of the switch group with shunt and series transformers can be seen in fig. 3; the instrument transformers are mounted on concrete blocks.

The oil switch (fig. 4) is of the multiple tank type, each three-pole group being formed of three single-pole switches coupled by means of chains and chain-wheels.

Each switch pole is provided with a worm-gear for lowering the welded tank, and as the suspension of such large tanks cannot be trusted solely to wire ropes, bolts are suitably arranged to take the weight of the switch. The cast-iron cover is fitted with pulleys to facilitate the removal of the switch. At an appropriate distance below the cover, a sheet-metal shield is normally submerged below the surface of the oil; the space for the expansion of the oil beneath the switch cover, containing some of the operating mechanism and where oil-gases may accumulate, is thereby protected against ignition through hot particles which may be produced during the switching operation. The porcelain bushings are fitted with tube-shaped cast-iron collars. The complete space for the expansion of the oil is thus surrounded by metal, eliminating the danger of explosion of the mixture of air and oil gases through sparks.

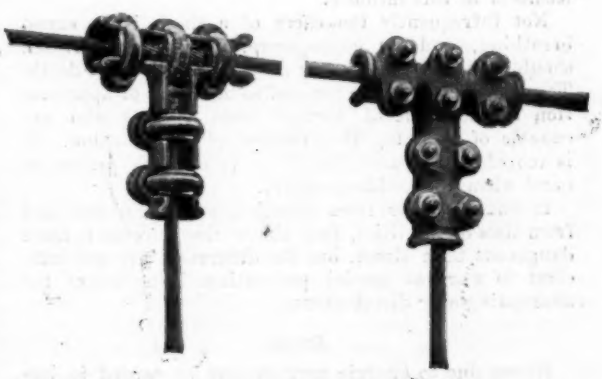
The resistance of the wiping contacts is independent of wear and tear, and the switch is of the multiple break type, *i.e.*, having eight interruptions arranged to form two main contacts and six auxiliary breaks, which gives a high switching velocity and efficiency cools the arc. Two of the breaks may be utilised for connecting a switching resistance, which is built direct into the oil tank, and the remaining contacts take care of the actual interruption of the circuit.

To obviate all risk of breakage of the moving parts due to the high switching velocity, porcelain has been eliminated, and the contacts are clamped to rectangular cross-bars of oil-resisting bakelite. The switches are fitted with series-trip coils actuating secondary contacts to trip the switches by direct current.

The electric remote control is effected through electromagnets assembled in such a manner as to be independent of the switch; the mechanical transmission of the movement is effected by chains in protecting tubes.

It will be seen from the diagram that choke-coils are connected in series to the shunt transformers; they consist of bare copper wire wound on a skeleton frame of impregnated hard wood.

The shunt and series transformers are of the oil-immersed type, and special attention has been given to making them weather-proof. In the latter a shunt resistance is provided for the primary winding to protect it against the destructive influence of surges. The 200-amp. isolating switches are of simple design, and are arranged for pole and hook operation.



FIGS. 5a and 5b.—CLAMPING CONNECTORS.

At the point of connection between the 62,500-volt busbars and the transformer oil switch, a three-pole isolating switch is installed. Each pole consists of three insulators, of which the centre one forms the pivoting point on the horizontally-moving link. All three poles are operated from the ground level by an operating lever provided with a locking device. Between the transformer oil switch and the 4,250-kVA transformer, further choke-coils are inserted, having an inductance

of 0.4 mH, which are located inside the building merely for reasons of convenient disposition.

The whole installation is built for a working voltage of 65,000 volts, and has been tested at 135,000 volts between live metal and earth.

Busbars and connections consist of bare copper cable, and the connections are made by means of clamping connectors, illustrated in figs. 5*a* and 5*b*, which not only guarantee a very intimate contact, but enable very large mechanical tensions to be applied to the lines.

The conditions of service of the outdoor station at Fribourg are interesting inasmuch as heavy ice and sleet conditions have had to be taken into consideration during the winter months.

ELECTRICAL HAZARDS IN INDUSTRY.

By J. S. PILLANS.

The substitution of electrical for mechanical power in a factory has the effect of eliminating many hazards, but unless correctly installed or handled may lead to the introduction of others no less dangerous. This will be apparent from the fact that while mechanical dangers are more or less patent to any observer, those arising from electricity are encountered without warning in the majority of cases.

In general, electrical accidents may be divided into four groups—

(1) Shock.
(2) Burns.
(3) Flash to eyes.
(4) Mechanical dangers.

It is proposed, in the course of this article, to deal with the above headings separately, to discuss briefly the risks of fire, but not, however, to deal with the particular hazards of high-pressure generation.

Shock.

The difference between a tingling sensation and a fatal shock may be governed by such factors as dampness of the parts of body in contact and consequent electrical resistance, area of part in contact, health and state of nerves of victim, path of current through body, material and condition of floor, and, finally, but most important, the voltage of shock received.

The path of current through the body is an important factor in regard to the severity of the shock as the current acts upon nerves and muscles, and thus, if the current passes from one hand to the other or from hand to foot, it may encounter sufficiently vital organs to result in death, whereas had the path been from finger to finger of the same hand the injury would have been localised to this member.

Not infrequently the effect of a shock is to arrest breathing, and, in consequence, artificial respiration should be at once applied in all cases of apparent death. There would appear in general to be a lack of appreciation of the value of having some persons who are capable of applying this method of resuscitation. It is too often the case that there is no such person at hand when the accident occurs.

It would appear from technical considerations, and from lists of fatalities, that alternating current is more dangerous than direct, but the differences are not sufficient to warrant special precautions being taken for alternating over direct current.

Burns.

Burns due to electric current may be caused in one of two ways. They are frequently occasioned at the point of contact between flesh and conductor, due to the heating and drying action of the current. They may also be caused by proximity to an arc, and steps should therefore be taken to avoid the accidental approach of persons to arcs, and, as far as possible, to eliminate the accidental striking of arcs between conductors and in such devices as switches and circuit breakers.

Eye Flash.

Eye flash, or injury caused to the optic nerve by the brilliance of the illumination from an arc, should be guarded against by the use of protective goggles whenever, as in the case of electric welding, the danger is present.

Mechanical Dangers.

It is impossible to lay down in the scope of this article means by which mechanical dangers due to electrical machinery may be avoided, as the question merely resolves itself, with one exception, into an entirely mechanical problem. The single exception, which should be mentioned, lies in the unexpected opening of circuit breakers, and when these are not sufficiently high to safeguard switchmen should they open unexpectedly, a railing or some other form of guard should be so placed as to ensure the safety of the men.

Causes of Electrical Accidents.

Switchgear.—A large proportion of casualties are due to contact with current carrying conductors which were erroneously assumed to be dead, and a large amount of these can be traced to the cleaning and adjusting of switchgear. It is impossible to lay down hard and fast rules for the elimination of accidents of this class, but elementary precautions require that the operator should first satisfy himself that the conductors are not, and cannot be, alive. When this cannot be ascertained definitely, some form of test should be made, and vacuum tubes and other forms of instruments are now on the market which should be utilised for the work, although lamps and voltmeters may usually be adapted for testing. Rubber mats and gloves should be more frequently used than at present appears to be the case, and additional precautions lie in the wearing of dry and untorn clothing, sleeves down to wrist and not rolled up, and the use, as far as possible, of one hand only, until the danger of contact from one hand to the other no longer exists.

In common with other industrial accidents, those due to electricity are caused more frequently by dangerous practices than dangerous conditions, and it is interesting to note in connection with this that a considerable proportion are found to arise from the use of portable apparatus and flexible wires, which, from their nature, cannot be encased in conduit, or similarly protected from mechanical damage. Frequent thorough inspection is necessary if danger is to be avoided, and flexible wires should not be passed round metal bars and rods, as is sometimes found to be the case in machine shops lighted with individual lamps, when workmen are at times discovered to have passed their lamp flexibles round parts of machines or structural iron work. In connection with high-pressure cables and insulated conductors generally, the unjustifiable assumption is sometimes made that the insulation in itself affords sufficient protection from danger, but experience shows that oil, damp, depreciation, or damage, may reduce its protective value to zero.

Motors.—Electrical equipment, in order to be safe and efficient, must be of good quality and workmanship. It must be suited to its work, correctly installed, and efficiently guarded, failure to comply with any of these conditions involving the introduction of an indefinite number of other hazards.

From Home Office statistics it appears impossible to

regard any voltage as being the maximum permissible to ensure safety, since fatalities are recorded in the report for 1921 from current at 220 volts upwards, while death from 110 volts the writer believes is on record.

In factories where voltages in excess of 250 are used, special precautions should be taken that all apparatus and conductors are completely encased, when practicable, or otherwise so efficiently guarded or fenced that accidental contact is impossible. This precaution is becoming increasingly important, but also correspondingly easy, in view of the present tendency to install a few large high-pressure motors in place of numerous small low-pressure ones. When fencing or guarding, wood is sometimes used, and has the advantage of being a non-conductor, but at the same time it cannot be looked upon as the best practice. Metal guarding is preferable, providing it is efficiently earthed.

It will be evident that on occasion motors can be placed in special rooms or compartments, or can be installed below the floor level, or in the smaller sizes, overhead, all of which represent considerable advances towards the elimination of electrical hazards. A further advantage of this procedure is that in such locations as machine shops, the motor can be rendered free from the possibility of danger due to chips, fragments of metal, and tools which may be dropped on it, or which may be drawn towards it by the field.

The enclosure of the contacts on starting rheostats is now almost a universal practice, and no doubt before long it will be a *sine qua non*. A curious defect in a protected type of rheostat which was observed by the writer lay in the fact that a steel pin ran through the handle, securing it to the radial arm, and not being protected on the outside; the consequence was that an unwary operator received an unpleasant shock.

Fuses.—In general, fuses may be classified into three types: link fuses, cartridge fuses, and plug fuses, and in their use two precautions are necessary, the first, protection to passers by from molten metal when the fuse is blown; the second, danger from shock when replacing the fuse. The molten metal hazard may be obviated by the provision of a suitable enclosure, which will probably be necessary only for fuses of the link type. Cartridge and plug fuses, from the nature of their design, seldom require protection of this description.

A point which the writer has noticed is that fuseboards of the enclosed type are not infrequently constructed without sufficient ventilation, and, consequently, the leaving open of the door to keep the temperature down results in danger from hot metal. Fuses of the cartridge type should preferably be withdrawn or replaced by insulated tongs, and it is good practice to withdraw the live end first and replace it last. It is more satisfactory, however, to provide master switches, such that the fuse can be rendered dead beyond any possibility of doubt.

Fire Hazard.—The formation of arcs, and the overheating of motors, generators, and other electrical apparatus, which constitute the chief causes of electrical fires, can best be insured against by the use of only the best materials and workmanship during installation. The insulation of wires and cables should receive a rigid inspection before use, and care should be taken that all joints are properly sweated and insulated, while no damage must be caused when the wires are drawn through conduit. Wood casing should not be run in any position where nails may be driven by persons wishing to hang pictures, &c.

Fuses are sometimes replaced with wires of a larger current-carrying capacity than that intended for use, and many hazards are caused by this practice.

Wires and cables laid between joists of flooring should be adequately protected from rats and mice, whose teeth have been responsible for more than one fire, and, as previously mentioned, the twisting of flexible and other wires round metal is a particularly serious hazard in view of the rapidity with which insulation deteriorates in this event. Other methods, in which arcs are liable to develop, may be corroded or badly-adjusted switches and wall plugs; or any loose connections or faulty conductors generally.

The ordinary electric lamp has been known on occasion to cause fire by being closely surrounded with a paper or celluloid shade, and especially dangerous is this practice with lamps of the gasfilled variety.

The overheating of motors and electrical apparatus can usually be traced to such defects as damaged insulation, overloading, maladjustment of brushes, and to mechanical faults in relation to bearings, transmission, and alignment. These conditions should therefore be guarded against by periodical examination.

A curious incident concerning this subject which came before the writer's notice was the return for repair of an exciter yoke and magnets, which had been seriously damaged by the application of sand whilst the machine was running, evidently applied with a view to extinguishing a fire. On examination it was discovered that the fire had been caused solely by the wearing of one of the bearings, which had become so far out of alignment that the armature struck fire from the pole-shoes. Hence the sand had done more damage than the fire which it was supposed to extinguish.

In cases of this description, carbon tetra-chloride is a more suitable extinguisher, as the use of sand can hardly be expected to result in other than serious consequences.

This concludes the notes on the more frequent of the electrical hazards encountered in industry, and the company with which the writer is associated is making a practice of distributing to all interested copies of the rules reproduced herewith. It also encourages the instruction of a certain proportion of workers in factories where electricity is used, in artificial respiration, and its experience shows that the ELECTRICAL REVIEW Artificial Respiration Chart should be posted in all such works, whether required by law or not.

Rules for the Prevention of Electrical Accidents.

(1) Don't assume that because a conductor is insulated, it is necessarily safe. Insulation can deteriorate so that it becomes useless.

(2) Don't clean or adjust switchgear or other apparatus until you are perfectly certain that it is dead. When possible, carry out tests with voltmeters, lamps, or special instruments.

(3) When cleaning or adjusting switchgear, use a rubber mat, and, as far as possible, work with one hand only.

(4) Don't replace fuses with any material of a different current-carrying capacity, or other than that intended. When replacing fuses, withdraw the live end first, and replace it last, whether the current is flowing or not.

(5) When a switch is provided for isolating fuses, remember that it is for your protection, and should therefore be used.

(6) Don't allow flex and thin cables to trail over the floor. Metal chips, falling tools, or ironshod boots can easily cause an accident.

(7) When men are working on circuits, all switches on which their safety depends should be padlocked open, and warning notices posted. These precautions should only be removed by the man who made them.

(8) Don't carry steel rules, centre punches, bunches of keys, or similar metal articles in your pockets while attending to electrical machinery or switchgear. They have been known to cause severe accidents.

(9) When installing new machinery be certain that all frames and metal guards are efficiently earthed.

(10) When connecting knife switches, so arrange them that when in the "off" position the blades are dead.

(11) Don't wind flexible wires or cables round metal parts of machines or structures, especially those of square section.

(12) In case of an accident, at once take steps to remove the victim from the circuit, but in so doing only use some non-conducting material, such as wood, cloth, or rope, or some loose part of his clothing, or switch off the current.

(13) If breathing has ceased, apply artificial respiration without delay. Many lives have been needlessly lost through neglect to do this. Cases have been known where men have revived after two hours' treatment.

(14) Don't enter battery rooms with a naked light. The gas generated is sometimes explosive.

(15) When wiring battery rooms it is preferable that switches and fuses and plug connections should be fixed outside to prevent danger from the above-mentioned cause.

(16) Don't close any switch unless you are perfectly familiar with the circuit which it controls, and are aware of the reason for its being open.

SOME EXPERIENCES OF A CHANGE-OVER.

By H. CORNER.

The object of this article is to give information concerning the replacing of consumers' appliances by the supply authority, when the system of distribution is changed from direct to alternating current. The experience recorded was gained as the result of a recent change-over of about a thousand consumers in a residential area.

Although certain Press notices are the only legal warning necessary to consumers, it is advisable to make a house to house canvass. When the meter readers are on their round they can make the necessary inquiries as to the nature of the load. A warning to those who "keep" records. Don't imagine you know what is on the mains. Only a change-over will reveal this; and be prepared for anything.

Most people are delighted to receive a new meter in place of the old. They think they are getting something for nothing out of the authority; and when bound on such a benevolent mission one is generally greeted with a smile. Occasionally one meets with a "What's the game?" sort of fellow, who, by the way, is generally a woman. Many of the direct-current meters had not been changed during the war, and on being brought in were found to be, on the average, 8 per cent. slow. Some of the new meters would be 2 per cent. fast. At the end of the quarter most of the consumers had developed a theory as to the reason of the change-over, and for about a month after none of the mains staff dare venture out before dark. If anyone wants to study psychology let him join a mains staff, and serve through a change-over. The change-over of supply is nothing compared with the change-over in the temperament of the people.

Irons should be serviceable on both supplies, but with most makes it will be found that the iron does not heat up so readily on alternating current. Consumers have an irritating way of pointing out this fact, and it takes some explaining away.

The same feature is common in the case of radiators, only to compensate for this the alternation causes vibration, and this noise gets on to the nerves of the consumer. In one case which had to receive the writer's attention the radiator stood on a tiled fireplace, and the noise could be termed a nuisance. The writer took up the radiator, examined it in the approved manner, made some slight adjustment, and put it down on to the carpet, and the noise practically ceased. The writer has not been near the house since.

Certain types of motor machines, such as vacuum cleaners and hair-dryers, which are supposed to be universal, do not run so well on alternating as on direct current. The speed drops about 30 per cent., and in the two cases mentioned the apparatus are useless. In a few cases the writer cured the trouble by inserting resistance in the field circuits. Old radiator spiral is useful for this work, and can generally be stowed away in the carcase of the motor.

Battery charging is a problem to be faced. On this change-over the difficulty was met by installing small motor-generator sets. A convenient size is one which gives 15 secondary volts with a full-load current of 7 amps. With a 2-amp. load the voltage will be 25, and to facilitate charging, a field resistance should be included, as any resistance which is used direct off the mains will generally be found to be too large.

Violet-ray and other medical apparatus will have to be converted, and while these present no serious difficulty, trouble arises from the fact that the consumer does not think it necessary to declare such property, and the first intimation that anything is amiss is when some gouty old person storms into the office with a parcel under his arm, and wants to know why there is a conspiracy against his person. The agility displayed by some of the afflicted is amazing, especially in view of the fact that they have not had the use of their apparatus for a few days.

The replacing of the direct-current apparatus used in connection with organ-blowing is a task best left to some firm which specialises in this class of work. Pressure varies as the square and volume as the cube of the speed, and so there should not be much difference between the speeds of the two machines. The blower and the motor are generally connected by a flexible coupling, but the difficulty of the change does not lie so much in the changing of the machines as in the choice of controlling device.

The alternating supply was single-phase. The area of supply to be changed was divided into sections, and an e.h.p. single-phase feeder was run to a sub-station in each section. By bringing out a central point in the transformer secondary, it was possible to use the direct-current distributors and have an alternating three-wire supply. By this means, motors, although single-phase, could be either 230 or 460 volts, depending on their size. Most engineers have an idea that single-phase motors do not operate as well as direct-current machines. This idea is confirmed after a change-over. The motors used may be divided into two classes: those from 1/6th to 2 h.p., and those from 2 to a maximum of 7 h.p. Some of the smaller ones were series machines, and the rest, excepting the 7-h.p., were squirrel-cage. The 7-h.p. motor had a wound rotor, with variable resistance.

Starting trouble was the chief difficulty with the motors. The smaller class had "Twinob" switches as starters. An unloaded motor often refused to start. It seemed as though the rotor was locked when in a certain position. The motor would pick up if the rotor was turned a little from this position. The direction of rotation depended on which way the spindle was turned. If the motor started on its own it would run very slowly for about ten seconds, and then very suddenly pick up speed. The same trouble was experienced with the larger class. All the machines had to be provided with loose pulleys, and even with this assistance starting was a slow, grinding business. The starters were of the common spiral type. The starting winding was cut out after the second stop, and, of course, one had to wait on this stop until the machine gathered speed. Consumers would not do this, and for weeks after the change-over the staff were giving lessons on starting. A small overload brought the machines instantly out of step. One motor was fitted with a clutch pulley, but this did not survive a week on a sausage machine. Shortly after the change-over a contractor fixed a 2-h.p. motor on this section for a

new consumer. The contractor could not get the machine to start, and deserted, so the consumer asked for our assistance. The supply main entered the premises at a point which was 50 yards from where the meter was fixed. The consumer's mains were 7/.036. On open circuit the supply voltage was 230, but this dropped to 185 when the starting handle was put on the first stop. The current was 30 amperes. Difficulty was experienced in starting this motor.

Some of the new meters were a source of trouble. Many messages stated that there was an alarming noise coming from the meter cupboard. Investigation proved that this was caused by the rotor coming into contact with the pole pieces. This was soon put right, but another bad habit, "creeping," was not so easily cured.

Fifty complaints were received about bad light and flickering. The writer spent many hours in damp, dark cellars watching a voltmeter and studying voltage curves. The root of all the evil was in the consumer's main switch. The negative pole was covered with a blue, insoluble substance, which could not be cleaned. In every case a new switch cleared the fault. Needless to say, some of the consumers thought that the supply authority should have provided the same.

Everything must have an end, even a change-over; and now, complaints rectified, consumers are happy once more. A reduction in price has proved the mains man's contention that the change-over was for the consumer's benefit. The mains man's prophecy has become the mains man's pride.

OIL RING LUBRICATION.

By J. T. TOWLSON.

THE writer's experience, covering many years, in the provinces and in the metropolis with motors and generators, both a.c. and d.c., has been convincing that with proper care and with oils possessing the necessary viscosity, and with suitable provision effectually to contend against draught, oil-ring lubrication will be found absolutely dependable.

Considerable trouble was met with when oil-ring lubrication was first introduced in connection with d.c. motors and generators. The cause of the comparative failure of the ring-oiled bearing was a strong draught arising from the action of a particular form of armature winding, which was detrimentally effective in exhausting the bearing of its oil, and running it dry and dangerous. The fault being localised, a remedy had to be put forward. Instead of the end of the armature having a series of protruding bars, acting fan-like on the adjacent journal, the armature end was smoothly covered with well-shellacked cotton cloth. This was most effective in disposing of the cause of the trouble, and oil-ring lubrication forthwith came to stay.

The oil-rings are made by some firms of gun-metal from castings of tubular form, bored and turned truly concentric. These answer their purpose very well indeed, and would be advocated, were it not for the unnecessary cost involved, in the use of such an expensive material. Other firms—manufacturers of lower-class goods—make their rings out of commercial brass tube, and produce them by just "papering" them inside and outside and parting them off from the tube. Never was there a greater mistake. They are inexpensive to produce, it is true, but many ruined journals are immediately traceable to such mistaken parsimony. The essentials of and for an oil-ring are concentricity and uniformity of width and weight, and if such essentials are absent, then the ring will not rotate with the shaft and effect its lubrication.

Between the two extremes referred to above lies a plan less expensive than the first, and yet equal to that in the result, *i.e.*, to turn and bore the rings truly from extra-thick commercial brass tube.

The rings should be made approximately twice the diameter of the journal it is required to lubricate, and the width about one-half of the shaft diameter. As regards thickness, it has been proved by experiment that the thicker the ring, with its consequently increased weight, the more dependable is the rotation with the shaft, the oil allowing the greater surface of the heavier ring to pass through it with less increase of friction compared with the frictional drive of the heavy ring by the shaft.

Chain oiling is good and dependable "as long as the chains endure," but it may surprise many to learn that though the chain, with its links and pins, is covered with oil all its working and non-working time, one ring will outlast twenty chains; it is by no means uncommon, when a machine has been dismantled where chain-oiling has been used, to find the links and pins altogether out of commission and lying snugly at the base of the oil sump. Those in "the trade" are familiar with the reason for the adoption and use of chains, but in case some have never heard, and others may have forgotten, it may be said that the practice arose in a not altogether first-class concern, where couplings were frequently required to be fixed on the ends of shafts adjacent to a journal which needed oil-rings. As is well known, these rings must always be put in place before the coupling is keyed on. So, to pander to the careless mechanic, that particular concern adopted chain oiling, and others, not knowing better, followed in its steps.

A Large Electric Lamp.—A 30,000-watt incandescent light bulb was one of several electrical features of the 16th annual convention of the Illuminating Engineering Society at Swampscott, Mass. (says the *Evening News*). The bulb is the largest of its kind ever made. Two special generators were lent by the Army to operate the lamp at Swampscott. The bulb was suspended from a pole in front of the hotel where the electrical experts had their convention. The light it produced at night was so powerful that objects a quarter to half-a-mile distant were easily discernible. When the lamp is lighted a temperature of about 3,500 deg. C. is generated in the filament, and an electric fan is used to cool the bulb. The glass part of the lamp is approximately 18½ in. long and 12 in. in diameter. The giant light was made in the same manner as the ordinary size bulb. It has four coils of drawn wire. The ordinary "hard glass" of the type found in the usual incandescent light is used. Thirteen lamps similar to the one exhibited have been made. They are designed for use in moving-picture studios. It is claimed that such lights are more suitable than arc lamps because of the absence of the flicker and the softer tone of the light rays.

Sweden's Water Powers.—Some time ago a committee was appointed by the Government of Sweden to investigate the question of the extension of electricity supply throughout the country, and a report on the subject is expected to be issued in the near future. In the meantime the engineering secretary to the committee is reported to have stated that no difficulties would be experienced in carrying out the electrification of the whole of Sweden, as the resources available are computed at from 30 to 35 milliards of kilowatt-hours. It is, however, estimated that the requirements of the country about the year 1940 will represent six milliard kW-hours, of which one half would be needed by the big industries, excepting the electrochemical industries; and the railways would need about 15 per cent of the total probable consumption in question. The committee has divided the whole of the country into 14 districts for the establishment of a distributing network, the districts being fixed according to the situation of the waterfalls.

TRANSATLANTIC RADIO-TELEPHONY.

A Successful Demonstration of its Possibilities.

IT will be recalled that about seven years ago the American Telephone and Telegraph Co., making use of the United States Navy antenna at Arlington, Virginia, carried out a series of tests for the purpose of demonstrating radio-telephony carried on entirely by means of thermionic valves. Observers at Paris, Honolulu, and Darien during September and October, 1915, heard speech at all those points—the first successful long-distance tests—and the record established between Arlington and Honolulu has never been broken. Those experiments, however, were in no sense commercial, but since then great progress has been made in the design and commercial value of high-power vacuum valves and in their application to radio-telephony and telegraphy.

This fact was successfully demonstrated early on Monday morning last, when we had the privilege of being present during the reception of speech by the International Western Electric Co., Inc., and the Western Electric Co., Ltd., which companies are co-operating with the American Telephone and Telegraph Co. and the Radio Corporation of America, with the object of determining the best conditions for transatlantic telephony.

Messrs. Thayer, Carty, and other speakers used office telephones at 159, Broadway, New York, and a 70-mile land line conveyed the speech to the radio transmitting station at Rocky Point, Long Island. The antenna used is 450 ft. high and 1¼ miles long, being carried on six towers; the 20 10-kW water-cooled valves, similar to that described in our issue of December 15th, 1922, p. 921, are each capable of dissipating 26 kW, but the actual output during the tests was 60 kW, the wave length being 5,000 m.

The demonstration took place at the new Western Electric factory at New Southgate, North London, where the speech was received on a 6-ft. frame aerial in conjunction with a total of eight valves—one oscillator, three ordinary, and four extra amplifiers—which enabled the 60 listeners to hear by means of ordinary head telephone receivers. A "loud speaker" was also used for a short period.

The speeches commenced at 2 a.m. and conversation in reply to cablegrams continued until 4 a.m. Throughout, speech was clearly audible with hardly any variation in volume, and very little interference.

The accomplishment of the Western Union Telegraph Co., though less spectacular, was noteworthy also, for it maintained direct cable communication between New York and New Southgate, and several messages were transmitted to New York in under one minute.

In the present tests, which are entirely one-way, a large advance has been made by sending out from the transmitting station only that component of the modulated wave which is essential to the production of intelligible signals. In the usual method of transmission not only is this essential component radiated, but also one which is an exact duplicate of it which contains no element of signal whatever. The effect of the new method of transmission, which, it is claimed, has never been used before, is that the same intelligibility of signal is secured with an expenditure of only one-third or one-fourth of the power previously required at the transmitting station. The transmitter used in the tests is able to supply 200 kW to the antenna, which would be equivalent to at least 600 kW in a system (if such existed) transmitting the complete modulated wave. Another great advantage of this method of transmission is that the range of frequencies occupied by the transmission is less than one-half that required in the ordinary methods. This advantage, while not of extreme importance in the broadcasting range, is of predominating importance in the limited range of frequencies available for long-distance radio communication.

One of the controlling factors is that the band of frequencies (or wave lengths) used in transmission should be as small as possible because bands at low frequencies (long-distance operation) are valuable, a range of only 50,000 cycles being available to carry the entire transatlantic traffic, both telephone and telegraph. Now, intelligible speech requires the use of about 2,000 cycles (telegraph 200), and it is important that, in modulating a radio-frequency carrier to produce radio signals, it is not done in such a way as to occupy a greater range than this. The common method of transmission, such as is used in broadcasting, requires more than twice the range of frequencies in the modulating speech, but since broadcasting is done at much higher frequencies this is not important.

Because of the very large difference between the disturbances in summer and winter, the transmitter power output, without requiring investment of capital in peak-load apparatus, which is idle a great deal of the time, should be capable of variation from, say, 100 to 1,000 kW.

For telephony, all the major requirements may be met by one system. The use of the minimum frequency range may be secured by transmitting only one "side band" of the complete modulated wave instead of both side bands and the carrier wave. This method is now in use in the wire-carrier telephone system of the American Telephone and Telegraph Co. and its associated companies.

The greatest power efficiency is also realised by this method of transmission, together with the use of three-element vacuum tubes throughout. This is the type of system used in the tests. The single side band is selected at low power and then amplified by means of water-cooled power tubes up to a level of about 60 kW and radiated from the antenna, this being equivalent to more than 200 kW of the complete modulated wave.

At the receiving end—in this case London—the missing carrier-frequency component is introduced by means of a local vacuum tube oscillator and the then complete signal detected to produce the original speech sounds.

While it is much too early to draw conclusions, it is interesting to know that between January 1st, 1923, when the receiving apparatus was installed, and January 15th, 1923, a signal-to-noise ratio of 10 or greater was maintained every test day for 14 hours (between 11 p.m. and 1 p.m. Greenwich time), and fairly good telephone speech could be heard *at any time* between these hours provided near-by stations were not working in the frequency range used, from about 56,000 to 59,000 cycles per second. This, however, is the most favourable time of year, and in the summer, when disturbances are much greater, a correspondingly greater amount of power will probably be needed for the same results.

Measurements have been going on for some time in America, and since the first of the year the experimental station at New Southgate, used in the transatlantic demonstration of January 15th, has been making field strength determinations. Simultaneously the values of electrical disturbance are measured and separated into the parts due to continuous-wave interference and to "static"; it would require a year to cover a complete cycle.

When all this information is obtained, it will be possible to determine the cost of a radio circuit of the required excellence and also the way in which the cost varies with the goodness of the circuit, so that definite data will be available for the engineering of a communication system.

In conclusion, Mr. F. Gill, European chief engineer of the International Western Electric Co., and his staff, as well as Dr. H. W. Nichols and Mr. H. T. Friis, of the Research Department of the American Telephone and Telegraph Co. and the Western Electric Co., who have come over from America in connection with the experiments, must be most heartily congratulated on the success that has attended their efforts. The results obtained cannot be described as "freaks," and are therefore of the utmost importance.

It is important to realise the tremendous difference between the occasional reception of radio-telephone signals (for example, those from American broadcasting stations) and the continuous and reliable reception of telephone messages for commercial purposes. For limited periods (in the night in winter) it is possible to receive, in England, telephone messages from low-power, short-wave, stations in America, but during the daytime and for the whole twenty-four hours in summer the strength of signals received from such stations is so minute compared with the always-present electrical disturbances that reception is entirely impossible. It is necessary to make use of longer waves and very much greater power to ensure reliable transmission. This fact has long been known, but the public is likely to be misled by the accounts which always appear during the winter time of freakish results in the reception of short-wave signals.

DOMESTIC LOAD BUILDING.

DISCUSSION AT LIVERPOOL.

MR. W. A. GILLOTT'S paper on the above subject, which was abstracted in our issue of December 8th, 1922, was read and discussed at the Liverpool Sub-Centre of the North-Western Centre of the INSTITUTION OF ELECTRICAL ENGINEERS on December 11th, 1922.

MR. DICKINSON said that the manufacturers had made up their minds that there was good business to be done, and all must agree with the suggestions the author made. The difficulties facing electricity supply undertakings were two: In the case of d.c. supply over very long distances from sub-stations they were bound to find trouble in keeping up the pressure at the ends of the distributors. It was of no use going in for a big campaign to develop the use of domestic appliances until they had some method of dealing with the load that it gave. On an a.c. system it was comparatively easy to add additional sub-stations, but when a new d.c. sub-station had to be installed, it was a very costly matter. In Liverpool they had installed automatically-controlled sub-stations. They wanted a two-part tariff, a fixed rate, and a low-running cost, but what was the fixed rate to be based upon? The rateable value system was not ideal by any means and had the disadvantage that in the better-class areas of a town the fixed charge bore a higher proportion of the total cost than was the case in the poorer districts.

If the tariff was fixed on the kilowatt basis, it meant that the number of lights must be checked every year. Had Mr. Gillott considered the area occupied by the house as a basis or the number of rooms in a house?

It was very desirable to interest ladies in this class of work; if the lady of the house only knew what amount of work she could save, she would do the canvassing for the supply authorities. He spoke from personal experience.

MR. J. E. NELSON was of the opinion that if the demand was a profitable one, they must offer cheaper rates and, if they could afford to do that, the domestic load would build itself without any very elaborate organising effort. The best propagandist was a satisfactory service, which could not be given without reliable appliances. Electric heating, while equally as profitable to the supplier as electric cooking, was more easily introduced in the home by reason of the relatively cheap apparatus obtainable and its more obvious advantages. When the electric habit was thoroughly established electric cooking might become general, but from the point of view of propaganda work, heating was a safer recommendation than cooking to the domestic electricity user. Taking the published rates of 10 undertakings in south-west Lancashire and Cheshire, the lowest heating and cooking rate was 1½d. and the highest 4.4d., while the majority were not less than 2d.; at those rates electric heating and cooking was a luxury—quite worth paying for by those who could afford it, but rather out of the reach of the type of consumer the supply authority must cater for if it was really to dislodge the gas suppliers and put electric heating and cooking in the same position as electric lighting.

A low flat rate was more likely to attract the domestic consumer than even a more favourable two-part tariff which was difficult to explain to the housewife; the speaker did not care for any two-part tariff which was not based on measured maximum demand. The electric iron was a valuable propagandist, but many makers spoiled an otherwise good job by providing a miserable connection for the flexible. Every small electrical trouble tended to shake the confidence of the user in all electrical appliances, and a consumer who had used an iron for twelve months without any trouble was more likely to install cooking and heating apparatus than one who had been bothered with shorting flexibles. The electric cooker must be reduced in price if it was to become an article of general use. The mechanical details in small domestic appliances were frequently faulty, especially at the terminals, and if manufacturers would pay more attention to such points and supply an article less easily damaged and more easily repaired, they would help to foster the domestic load.

Many supply undertakings had not a suitable distributing system in being to meet increased demands without considerable additions to mains and services which it would have been foolish to undertake at the prices ruling until recently. That no doubt partly accounted for the slow progress made in recent years.

MR. O. C. WAYGOOD said that the financial aspect of the problem was what the public would require information about, and propaganda work of the nature outlined in the paper would not be very convincing. A drawing-room coal fire would consume one cwt. of coal in 60 hours which, with coal at 45s. per ton, would cost approximately 0.5d. per hour.

To make a 2-kW electric fire equal to that in cost of running, energy would have to be supplied at 0.25d. per kWh compared with 2½d., the figure quoted in the paper; in addition, the maintenance charges due to the elements fusing would have to be met.

With regard to cooking, relative figures of the prices of electric and gas cookers, and cost of hire, might be useful:

Cooker.	List Price.	Cost of hire per annum.
Electric ...	£22 ...	20 per cent. = £4 8s. 0d.
Gas ...	£10 ...	3 per cent. = £ 6s. 0d.

From that comparison it was estimated that with electrical energy at 0.5d. per kWh and gas at 30d. per 1,000 cu. ft., cooking became a financial proposition. The author referred to the present tendency to charge 1½d. per kWh, but experience suggested that the inclusive figure was much higher, facts that must be faced and dealt with in any propaganda programme.

If it was impossible to supply cheap energy, efficiency with reliability should be the aim of manufacturers of domestic appliances. Several tests had been made in the laboratories of applied electricity of the University of Liverpool in order to arrive at the efficiency of apparatus used for raising water to the boiling point. The efficiency of the immersion type heater, under ideal conditions, was 90 per cent.; that of the well-known immersion type element heater averaged about 80 per cent. under normal conditions; and the maximum

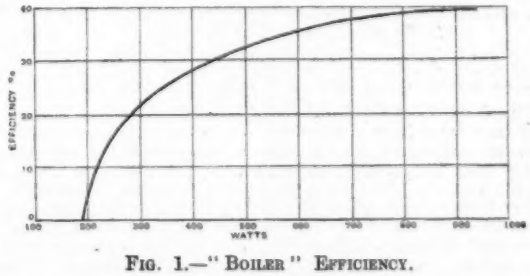


FIG. 1.—"BOILER" EFFICIENCY.

efficiency of the standard flat-ring boiler (about 0.75 kW capacity to boil 1.6 pints) was 38 per cent. (fig. 1). Those figures showed that in order that customers might get the best results, the immersion type was the one the manufacturers should standardise for kettles.

MR. E. MOXON agreed with the author that it was absolutely essential that an experienced staff should be available.

The figure of 300 kWh per annum as the average demand in houses for lighting purposes was somewhat high for large houses, but about right for smaller property. He did not agree with the author's combined tariff; in fact, the author's

suggestion to rate on the combined charge in its present form destroyed the object of the maximum-demand system and was little better than a maximum-demand charge for lighting with an independent flat rate for heating, with the saving grace that it only required one meter with common wiring for all purposes.

The speaker preferred a similar form of tariff with a fixed charge per kW of maximum demand having a minimum annual payment against that portion of the rate to cover standing charges suggested for the lighting installation, together with a low flat rate per kWh consumed, reducing either by a sliding scale or discounts, applying only to certain consumptions per kW of maximum demand, the lower rates to apply successively after calculating the charges due first on the higher rating progressively. Such a tariff would require the addition of a demand indicator to that suggested, but only one meter, whilst the wiring could be common for all purposes.

With regard to the domestic load on Sundays, the author's conditions applied to industrial towns and not to those of a purely residential character.

MR. A. S. WILSON thought the matter was now purely commercial and its successful development depended upon co-operation between supply authorities, manufacturers, and contractors. From the manufacturers' point of view, the supply authorities could still do a great deal of advertising, as the consuming public looked to them for information more than it did to the contractor or the manufacturer. Many a good word could be put in by the supply authorities if their representatives, such as meter readers and inspectors, who regularly visited consumers, were to take all favourable opportunities for propaganda work amongst actual consumers.

The cost of selling to-day, particularly in that line of business, had reached a very high figure and it required to be spread a little more fairly over those benefiting from the sale of both apparatus and power. Another direction in which they might further the cause was that the supply authority might strongly urge on each new consumer that a reasonable number of power plug points be initially installed with a view to the extension of that load as such advice would be more readily received from the supply authorities than from the contractor. Most existing installations could carry two or three times the amount at present connected up as a number of small appliances could be operated from existing points now only supplying, say, a 30-watt lamp, which were available for, say, 500/600 watts.

MR. R. W. WATSON said that from the electrical contractors' point of view the author's suggestions were valuable. In Liverpool the supply authority laid a main into a house to deal with at least 5 kW. Usually the consumer started with a lighting load only, and when he required power for heating or cooking, the contractor had to tell him that the service switches must be charged, the cost of which was often more than that of the actual wiring to the power-consuming point. If the supply main was always installed for a minimum of 25 amperes it would be reasonable for the service switches, &c., to be of the same size, assuming that the charge for lighting or heating was a flat rate, which was desirable as it was much easier to get the consumer to understand that rate. The supply authority need not offer separate rates, a mean rate could be found for all purposes. The author's fixed charge per kilowatt on the two-part tariff was too high and as regarded his suggestion of municipal showrooms, contractors would have no objection to that provided sales were not made direct to the public. The showroom should not be run for profit, but be a charge on the electricity department. It would be of benefit if the electrical departments of municipalities had occasional informal meetings with the contractors in their districts to discuss propaganda work.

MR. H. P. TAVERNOR explained that in his district where the average house only had from ten to twelve lights it would not be advisable to have a two-part tariff. An electric fire, kettle, and boiling ring were far better than a cooker in that size of house, and the ordinary lighting and power rate was by far the best, as the two-part tariff was too complicated.

MR. J. H. COLLIE pointed out that very few supply authorities had been in a position to supply the necessary power because their distribution mains were not of sufficient capacity. Other very important drawbacks were the high cost of electricity, and the fact that most premises required extra wiring for anything above 500-watt circuits. Perhaps some arrangement of free wiring, or payment by instalments, might get over that difficulty. They were also rather handicapped in this country as compared with America in fittings. The standard bayonet lampholder was not nearly so suitable for power connections as the Edison screw type, which would carry anything up to the capacity of the flexible supplying it. Also the ordinary tumbler switch was not so good as the American rotary switch. It was therefore not safe to use articles which took more than 3 or 4 amps. on the majority of lighting circuits. However, it was now possible to get bayonet holders and tumbler switches which were a great improvement on the old ones from a current-carrying point of view, and if supply authorities encouraged the use of these types for any installation where it was likely that the smaller domestic articles would be used, it would not be necessary always to install separate circuits and plugs.

MR. S. E. BRITTON said that his house had been completely electrified for more than 10 years, and he was quite satisfied that the results that could be obtained from lighting, cleaning, and cooking could not be obtained by any other means. He agreed with the author's point of view regarding showrooms, advertising, exhibitions, and other means of giving publicity to the value of electricity in the home. The one unsatisfactory feature of publicity propaganda was that it was extremely difficult to gauge the actual amount of business obtained by such means. Any developments which took place after publicity were naturally attributed to it, whereas it was possible that some of the developments might have taken place without any effort on the part of the undertaking. For that reason he did not believe in spending large sums of money; frequent inexpensive reminders were probably all that was necessary to achieve the objects in view. He agreed with Mr. Dickinson that it was essential to have a two-part tariff, but it did not seem to be very important whether it was a kilowatt charge, a maximum demand charge, a two-rate meter, or based upon the rateable value of the property, or upon the floor space as in Dundee, for meeting the standing charges along with a low price per kWh. He knew of no two-part tariff which was absolutely correct. It became a matter of expedience, and so long as a tariff was in use which enabled the business to be obtained on a profitable basis and the consumers were reasonably satisfied with the cost, it was not of great importance which of the foregoing methods was adopted. The diversity factor of 9 to 1, referred to by the author, was a very encouraging achievement. If the author could obtain additional instances to confirm that very high figure the fear frequently expressed in connection with small undertakings concerning the inability of their systems of distribution to cope with domestic electricity supply and the cost of larger mains would soon be forgotten.

He had not yet been able to see the logic of the Electrical Contractors' Association's attitude towards municipal authorities selling electrical apparatus. The Association did not attempt to control the sale of electrical apparatus and the wiring of consumers' premises by supply companies, but as soon as local authorities embarked upon such work, contractors attempted to make themselves heard. They entirely ignored the fact that prior to the supply there were no contractors in many of the towns, and although the undertakers invested large sums of money in promoting the supply they were asked to await the pleasure of others to provide the needs of consumers in the sale of apparatus and the wiring of consumers' premises.

It was only necessary to observe the achievements of the gas industry to realise the extent to which the electrical industry suffered by electricity supply undertakings refraining from the sale of apparatus and wiring work. It was very often advantageous to develop the use of a particular piece of apparatus by supplying it on hire, but the opportunity should be given to the consumers to also obtain the apparatus on hire-purchase or to purchase it outright in the first instance.

LEGAL.

Alleged Shock from Tramcar.

THE Bolton County Court, on January 11th, was called upon to decide whether it was possible for anyone on a tramcar to sustain an electric shock. The case was one in which Jonathan Booth, tram driver, sued the Bolton Corporation for damages on account of shock, incapacitating him from work. He stated that he was teaching a probationer driver when the car refused to move, though the full 500 V was applied. Plaintiff gripped the canopy standard and found it alive, the result being that he received a shock. He could not remove his hand until the other man had shut off the power. The defence was that it was impossible for anyone on the car (even if the car were "alive") to sustain an electric shock because of the fact that the car was insulated. A medical specialist said he would never have dreamt, on examining the man's hand, that he had had an electric shock.

The Judge said that he was bound to accept the evidence for the Corporation that a person could not sustain a shock in the manner alleged. There must have been a sudden stoppage in one of the man's minor arteries. He found for the Corporation, with costs.

Fellows Magneto Co., Ltd., v. Armstrong Siddeley Motors, Ltd.

THIS action was down for hearing in the King's Bench Division on January 12th, by Mr. Justice Roche, but before it was reached it was stated by Counsel that the case involved a great deal of detail as to the construction of magnetos with which his Lordship ought not to be troubled. It had, therefore, been agreed that it should be heard by Sir Edward Pollock, one of the Referees.

The case was formally referred for hearing to the High Courts Official Referee.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Jackson Cooking Equipment.

One of the latest improvements in its cooking apparatus made by the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1, is the arrangement shown in fig. 1. This is designed, somewhat on the lines of a popular American type of cooker, to do away with the stooping necessitated by the slavish copying of coal-fired ranges and gas ovens. It will be seen from the illustration that three switches are provided each giving three heats in ovens and grills. The oven

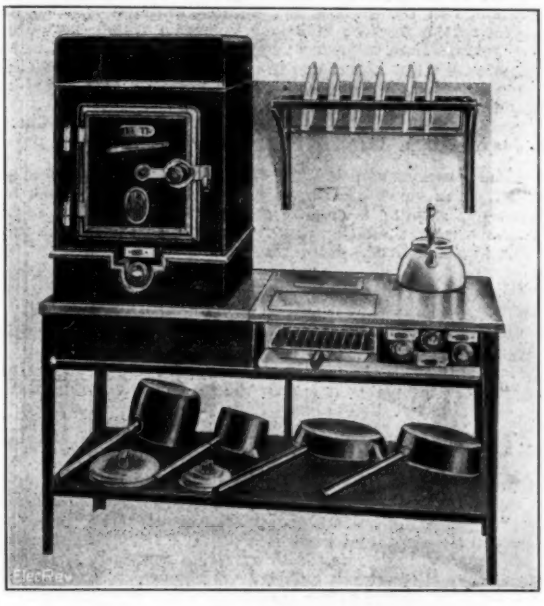


FIG. 1.—A NEW "JACKSON" COOKER.

elements are protected by steel guards, and consist of steel-reinforced fireclay wound with spirals of special alloy wire. As far as practicable, connections are made by solid rod and all mica insulation has been eliminated, as well as loose flexible leads. The framework upon which the oven is mounted is of cast iron and steel. A rack for plates is provided, as well as a hood on the top of the oven. Another useful feature is the shelf for utensils below the oven and grill.

The B.T.H. Broadcasting Receiver.

Of the numerous designs of radio broadcasting reception sets now on the market, that made by the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, is a good example. This set which is depicted in fig. 2 possesses a number of original features. As will be seen the panel is set in the box at an angle

FIG. 2.—THE B.T.H. CRYSTAL RECEIVER.

making the apparatus more easy to work than if it were in either a horizontal or vertical plane. The panel and insulation generally is of the chocolate-coloured composition used in the manufacture of B.T.H. magnetos. Two separate crystals are provided in a transparent covering. One of these is put into contact with a thin wire "feeler"; the other is in two parts (really two crystals) the faces of which are placed in contact. The use of a particular crystal depends upon the circumstances and the nature of the transmission. The wire and crystal are the more sensitive, but occasionally too great a sensitivity is a disadvantage. The tuning inductance is adjusted by a circular knob, and an index scale enables the best positions to be recorded. Although designed for the reception of short wave-lengths, provision is made for long-wave reception. There are two terminals, normally short circuited by a link, to which additional coils can be connected at will. A double earpiece, 4,000-ohm head-set of the firm's manufacture is a part of the equipment, and a complete single-wire aerial equipment is also provided.

The "Heatrae" Boiling Ring.

ELECTRIC FIRES, LTD., King Street, Norwich, has brought out a well-protected boiling ring (fig. 3), with a loading of 1,320 W, controlled by a three-heat switch. In this appliance

FIG. 3.—A "HEATRAE" BOILING RING.

the element is simply wound and is protected by a solid or open cast-iron top, secured by one screw in the centre. This arrangement makes the replacement of the element very easy. The plate is 8 in. in diameter, and is mounted on feet giving it a height of 5¼ in.; the weight is 7¼ lb.

A Commutator Soldering Machine.

MR. P. E. CHAPMAN, N.E. Corner 10th and Walnut Streets, St. Louis, Mo., U.S.A., whose armature testing device was described in our issue of July 7th, 1922, p. 31, has sent us

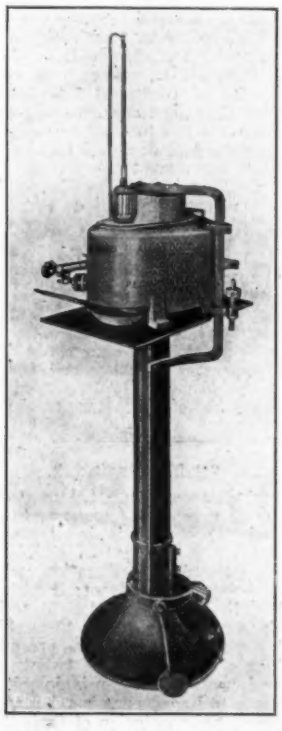


FIG. 4.—A COMMUTATOR SOLDERING MACHINE.

details of a machine (fig. 4) which he has brought out for soldering all the segments of a small commutator in the time usually taken to solder one by ordinary means. The com-

mutator is placed in position upon a suspended bar with the connections just above the solder in a container. The depression of a pedal raises the level of the solder and this performs the work. The solder container is provided with a jacket, which protects the operator from the heat of the fire or flame. The machine is made in two sizes. The smaller will take commutators of maximum and minimum diameters of 2 in. and ¾ in. up to 2 in. long. The capacity of the larger size is for diameters ranging from 2 in. to 4 in. and a length of 3 in.

Mr. Chapman's British agent is the Igranic Electric Co., Ltd., Bedford.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Motor-car Starter Problem.

I wondered if a reader could explain the following: A well-known make of motor-car starter, lighting and ignition coil set, was given to me to overhaul, in the course of my duties, with the complaint that the dynamo would not generate. On examination, I could not see anything wrong with it; after the usual tests, &c., I ran it at 2,000 revs., but not the least current could I get out of it. Still, it would act as a motor when connected to the battery. However, upon "wangling" the field brush I succeeded in getting 6 amps. out of it, in the "best position."

The owner would not go to any expense so advised us to "let it go at that," whereon the whole set was refitted to the car, and as soon as the engine had reached a decent speed, the ammeter read 16 amps. (which is the full rate of the dynamo). I inserted another ammeter in the circuit, but the reading was the same as on the original instrument. Can anyone offer an explanation of this?

Wouldn't Charge.

January 12th, 1923.

The Home Office Regulations.

Perhaps one of the most important points in connection with the above and relating to ironclad switchgear, is the correct interpretation of the protection of all live parts.

One sees on the market lines of switchgear by quite good firms in which these points are absolutely ignored.

In some cases, open terminals and clips are exposed, and yet a porcelain-protected fuse is placed inside the same box. The fuse conforms to the strict reading of the regulations.

In ventilating this point in your valuable columns, it may be that some of your correspondents, and particularly any member of the B.E.A.M.A., will express their opinion as to the correct meaning of the word "protection."

It would appear that the trade generally accepts the manufacturers' assertions as put forward so lucidly in their advertisements and leaflets, and does not inquire too closely as to what is or what is not correct.

What applies to the trade also applies to the borough electrical engineers, for they, with few exceptions, take little note of what is put on the circuit, so long as the switch has a good name.

A. W. E.

January 11th, 1923.

[With regard to the last sentence of our correspondent's letter, supply authorities' engineers, though they may of course advise consumers, have no rights and no duties in respect of the apparatus installed on consumers' premises. They, therefore, should not be held responsible for the design of these appliances.—Eds. Elec. Rev.]

Student Engineers.

I was both surprised and disgusted to read in your advertisement columns of this week's Review, that the Newcastle-upon-Tyne Electric Supply Co. is in the market again for student engineers. I would first of all like to congratulate the company upon the new designation which it proposes to give to the successful candidates; it certainly sounds and reads better than the old designation of assistant engineers, and thirty shillings a week, rising to forty shillings a week at the end of three years is, I suppose, presumed to be better than ten shillings a week rising to twenty shillings a week during the second year, but the principle is still there, and one naturally wants to know what is going to happen to these student engineers at the conclusion of their third-year course? Presumably, they will, like many more of us have, become blackberries, such as Ald. Kimber, of the Southampton Council, speaks of on page 67 of this week's Review.

It may not be generally known that some eighteen months ago upwards of thirty assistant engineers were dismissed from the staff of the Newcastle Co., owing to the slump in trade, and many of these men to-day are still unemployed, yet despite this the company is now in the market for student engineers who will presumably find, as many of us did in the past, that we were not student or junior engineers, but a means of providing the company with cheap yet efficient labour.

Observer.

January 14th, 1923.

A Strange Phenomenon.

Can any of your readers give me an explanation of this strange phenomenon often seen in the kinema? The wheels of cars and carriages, instead of revolving naturally, often appear to go backwards and drag. I first noticed this some years ago in the earliest war pictures, and put it down to a defect in the working of a new invention which science had not yet had time to perfect; but the sight of dragging wheels again only a few nights ago in one of America's latest "super films," called, I believe, "The Eternal Flame," set me wondering anew. Can anyone explain?

Cine-Car.

January 15th, 1923.

[The phenomenon is due to a well-known stroboscopic effect. The views are shown intermittently, and if the frequency of flashing is slightly greater than that of the spokes of the wheels, the latter will appear at each exposure to have moved back a little.—Eds. Elec. Rev.]

The Theft of Electricity.

Though it is so generally known by the supply authorities how easily the current can be diverted from the meter, it seems hardly creditable that no steps have been taken to rectify it; presumably it is only the small fry, whose personal pocket is affected, that is likely to make such a daring attempt, whereas the larger consumers—factories, &c.—are usually fitted with watt-hour meters, and would not dream of stooping to such actions.

An engineer of a small supply undertaking must be up to it, or he will find his revenue on the decline, especially as so many batteries are now being charged at home for motor-cars and wireless, and there is a reduced charge for these.

The type of cable referred to by Mr. Reynolds in your issue of January 5th certainly serves a useful purpose, but I prefer the outer or neutral better insulated (which is quite a simple matter) for localising a fault; I would prefer an "earth" at the power station rather than at every sertice.

I have for many years brought this defect in meter terminal box design before the representatives of meter makers, and urged a complete d.p. fuse unit and meter in one case. The tampering is usually done at the meter terminal box, and if the one unit is adopted, it is impossible to "short" the meter without taking off the cover; the whole unit would be cheaper, and a meter board dispensed with. The case is earthed automatically, as it should be.

I hope you will give your readers an opportunity of expressing their opinions on this important matter.

A. Preston,
Engineer & Manager.

Electricity Works, Carmarthen,
January 15th, 1923.

[Correspondence on this subject will be welcomed.—Eds. Elec. Rev.]

The Society of Technical Engineers.

With reference to the correspondence that has appeared in your columns recently with regard to the S.T.E., we suggest that there are two fundamental points that appear to have been lost sight of.

First, the need for such a society is just as great to-day as it was four and a half years ago, when it was being formed with enthusiasm among a certain small yet definite section of technical engineers. Indeed, the need is perhaps even greater.

The profession of technical engineer is still underpaid, compared with other professions requiring similar long and expensive training. It is still without its correct status within the industry in the minds of the lay public and of the Government. There is still—apart from the work the S.T.E. has already done—the same need among technical engineers for unemployment insurance, for superannuation, for employment bureau work, for legal assistance, for advice with regard to patents, employment abroad, &c.

There is also still the need for technical engineers in a corporate capacity, to bring their brains to bear on the problems of industry, and to take up in this manner their duty as citizens; in fact, owing to the present world-unrest and universal bad trade, this need is not only much greater than it has even been before, but is now of national importance.

Secondly, the engineers who belong to the S.T.E. are the S.T.E. If they changed their name, and became a part of another society, or became a new society, they would still be the same men, would elect the same colleagues to represent

them and would, in time, evolve exactly the same policy. They would, however, lose two or three years in the process, besides losing the prestige which the S.T.E. has already built up in certain quarters.

It is surely inconceivable that any sane man should seriously suggest to a group of men such as the S.T.E., who have banded themselves together for certain purposes and have progressed a certain distance towards their goal, that they should disband themselves and then, painfully and slowly, proceed to band themselves together again for the same original purposes!

Yet this is apparently what some of your correspondents suggest.

If any technical engineer wishes to improve the profession, to say nothing of his own position, he should join the S.T.E. and help to give it more weight. The heavier the weight, the quicker the results. If he does not wish to improve the profession, then the quicker he is out of it the better.

The policy of the S.T.E. has been attacked by your correspondents; nevertheless, this has been settled and approved by an overwhelming majority of its members. Moreover, it is right, and if persisted in will, we believe, improve the profession, the industry, and our own positions.

We shall, therefore, continue to be:

Six Members of the S.T.E. from its Foundation.

January 12th, 1923.

Improvement of Power Factor.

I note with interest Mr. Rogers's letter in your issue of January 5th. It was my intention to try and convince Mr. Rogers that static condensers are applied in numerous cases for the improvement of power-factor on low-voltage circuits, and are a practical commercial proposition. I think the evidence which has been published in your "Correspondence" columns should convince him of this fact.

With regard to his suggestion of my submitting an actual quotation for the particular case he has under consideration, I do not think it policy or advisable to put figures forward in the "Correspondence" columns of a technical journal, and there is no doubt that if Mr Rogers cares to put his problem before the makers of this apparatus he will then receive a quotation showing the scheme the makers would offer; if the case should be one where consumers are charged on a kVA demand basis, he would then be able to work out for himself the saving which would be effected.

H. Higham.

Helsby, *January 10th*, 1923.

Anticipating Mr. Higham's and Mr. Dorey's effective reply to Mr. Rogers on the single-phase power-factor problem, and risking the comparison which will naturally follow, I venture to put forward another solution, along with an actual quotation, for the improvement called for.

Mr. Rogers's installation consists of eight single-phase motors, totalling 28 h.p. These are presumably of the induction type, as the average load is ¾ full load, and the power factor 0.77. To improve the power factor to the required 1.95, I would install commutator motors of the self-compensated type, such as those manufactured by Messrs. F. & A. Parkinson, Ltd., Guiseley, in the place of the induction type, and would guarantee to give the result required.

Assuming for a basis of cost that the eight motors comprise six 3-h.p. and two 5-h.p., and the speed of the motors is 1,400 r.p.m., this conversion could be carried out for a total cost of £300, including the necessary graduated starters and re-wiring.

Against this outlay should be set the selling value of the motors and starters disposed of. To-day's price for new squirrel-cage motor and starters would be approximately £140, and for slip-ring motors and starters, approximately £200.

Naturally, a high price would not be obtained for these induction-type motors, in the particular locality concerned, where apparently energy charges are based on kVA.

However, anywhere else, which, strange to say, seems nearly everywhere, low power factor is not penalised, and a ready sale could be effected.

F. J. Stevenson.

Mirfield, *January 9th*, 1923.

I fully agree with the statement contained in the opening paragraph of Mr. E. W. Dorey's letter, which appeared on page 13 of your issue of January 5th.

Your original correspondent, whose letter appeared in your issue of December 8th, 1922, started off with 400 to 550 volts, but when challenged increased his case to 600 volts, thus conceding one of my main points, and has now apparently retired from this controversy.

In view of Mr. Higham's illuminating letter published in your issue of December 29th, 1922, I submit that a strong case is made out in favour of 600-volt condensers. Even Mr. Dorey supports this, *vide* page 14, item No. 1 of the ELECTRICAL REVIEW of January 5th, 1923: That if a kVA basic tariff is in force, 600-volt condensers plus an extraneous voltage boost, can be justified, but with a consequent increase in capital outlay.

W. E. Rogers.

January 14th, 1923.

[This letter has been abbreviated, and the correspondence on this subject is now closed.—EDS. ELEC. REV.]

Demand for Electricity.

The Borough of Wimbledon is not the only town experiencing an exceptional demand for electricity at the present time. The figures quoted in your issue of December 29th would require to be increased by 50 per cent. to equal the total of 1,461 new consumers who have been connected up in the Borough of Southend-on-Sea during the period March 31st to November 30th, 1922.

There is a waiting list of about 250, not counting services required in outlying streets beyond the range of the cables already laid.

The capacity of the station is now 4,280 kW, with a prospect of extension to 5,000 kW in the near future. The increasing demand for electricity in the borough is due to a large extent to the adoption of tariffs particularly applicable to various classes of consumers, including the very popular contract rate for dwelling houses, on which there are upwards of 6,000 consumers.

Robert Birkett,
Borough Electrical Engineer and General Manager.

Corporation Electricity Department,
Southend-on-Sea,
January 10th, 1923.

[Several letters have come to hand too late for insertion in this issue.—EDS. ELEC. REV.]

BUSINESS NOTES.

The "Electrical Review" Index.—The Index to Vol. XCI of the ELECTRICAL REVIEW, which will shortly be printed, will be supplied only to those who specially apply for it through the post. To these it will be supplied for 6d. post free. Any reader or advertiser, at home or abroad, who requires a copy for binding, or for other purposes, is asked to make early application therefor to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C.4.

Bankruptcy Proceedings.—F. H. THOMAS and W. E. EVANS, electrical engineers, Salubrious Chambers, Salubrious Place, Swansea.—First meeting January 23rd, at the Official Receiver's offices, Swansea; public examination February 23rd, at the Town Hall, Swansea.

W. SHAW, electrical engineer, 26, Westcliffe Road, Shipley, Yorks.—First and final dividend of 2s. in the £, payable at the Official Receiver's office, 12, Duke Street, Bradford.

R. A. DEPLEDGE (Scunthorpe Electrical Engineering Co.), electrical engineer, 53, Frodingham Road, Scunthorpe.—First and final dividend of 2s. 11d. in the £, payable at the Town Hall, Gt. Grimsby.

H. DOYLE (Accessories Supply Co.), factor in electrical accessories, 56, Hardman Road, Deansgate, Manchester.—Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester, released December 20th, 1922.

MARTIN & MCGREGOR, electrical engineers, Coltness Road, Wishaw.—Examined in bankruptcy in Hamilton Sheriff Court. The statement of affairs showed a deficiency of £1,315, and insolvency was attributed to losses on contracts.

DOUGLAS HY. GRIFFIN, electrical engineer, The Mart, South Shore, trading as the Midland Electric Co.—The bankrupt appeared at Blackpool Bankruptcy Court on Friday last to undergo his first examination. His liabilities were stated to be £233, and the deficiency was £162. The failure was attributed to bad trade, a bad debt, and depreciation of stock. Debtor had stated that he commenced business in June last year in partnership with his brother Lionel. They commenced at St. Anne's, each having £25 capital. As the partner was under the age of 21 he was not liable for debts, and could not, therefore, be made bankrupt. It was stated that debtor had gone on board a ship through "nervousness," and the examination was adjourned *sine die*.

J. K. FISH, wireless instrument maker, Sempolia, West Green Road, Tottenham, N.—Receiving order made January 11th on debtor's own petition.

W. W. THREAPLETON, electrical and mechanical engineer, Thornbury Road, Bradford.—Trustee, Mr. W. Durrance, Official Receiver, released January 11th.

F. WILDE (Liverpool Engineering Co.), electrical engineer, 18 and 20, Vauxhall Road, Liverpool.—Trustee, Mr. L. Nicholas, 19, Castle Street, Liverpool, appointed January 13th.

W. HURWORTH and A. A. WATMOUGH (Hurworth, Watmough & Co.), electrical engineers, 41, Town Street, Horsforth, and 1, Back James Street, Harrogate.—First and final dividend of 7d. in the £, payable January 25th at the Official Receiver's Offices, 24, Bond Street, Leeds.

A. A. WATMOUGH (separate estate).—First and final dividend of 6¾d. in the £, payable January 25th at the Official Receiver's Office, Leeds.

EDWARD MITTON, electrical and automobile engineer, Queen's Hall Buildings, Church.—At Blackburn Bankruptcy Court, on January 10th, the bankrupt appeared for his first examination. His liabilities were £541, the deficiency being £283. His failure was due to bad trade and want of capital. Regarding the ownership of an aeroplane, debtor said he sold it to a company for £200, and still had an interest in the takings. He was ground engineer. The examination was adjourned.

R. V. MAYNER, electrical engineer, Narrow Street and Wentworth Street, Peterborough.—Trustee, Mr. J. O. Morris, Official Receiver, 5, Petty-cury, Cambridge, released January 11th.

Dividend.—LIVINGSTON & MALCOLM, electricians, 7, Canal Street, Coatbridge.—Dividend payable February 27th, at the office of Messrs. J. E. Watson & Macharg, 30, George Square, Glasgow.

Company Liquidations.—THE C. P. PRESTON CO., LTD., 112, High Holborn, London, W.C., manufacturers of electrical and motor car specialities.—Under a compulsory winding-up order made against this company last November, upon a creditor's petition, accounts have been lodged showing liabilities £9,807, against assets valued at £982, and a total deficiency of £16,926 with regard to contributories. Mr. G. D. Pepys, Official Receiver and Liquidator, reports that the company was formed in April, 1920, with a nominal capital of £10,000, to acquire and take over as a going concern and carry on the business of Mr. Colvin Percy Preston at the above address. The purchase price was fixed at £7,000, and was paid as to £1,000 in cash and £6,000 in shares of the company. A net loss of £1,835 was made on the first year's trading, the total sales being returned at £3,774. To acquire this small amount of business the company, in addition to the £7,000 paid to the vendor, had expended £1,448 in advertising and printing. The business appears to have improved during the next year, ended March 31st, 1922, the sales amounting to £19,081, and a net profit of £931 being disclosed. Branch establishments were opened at Birmingham, Manchester and Newcastle, but they proved a failure. The collapse of the company is attributed by Mr. Colvin Preston to the bad state of trade, to bad debts and to long credits taken by customers.

THE MODERN ELECTRICAL SUPPLY CO.—In the Companies' Winding-up Court, on Tuesday, Mr. Justice Lawrence made an order for the compulsory liquidation of this company.

Dissolutions of Partnership.—CARTER & CO., electrical and mechanical engineers, 37, Manchester Road, Nelson.—Messrs. J. H. and F. Carter have dissolved partnership. Debts will be attended to by Mr. F. Carter.

BARROW & CO., electrical engineers, 6, Stanley Street and Horrocks, Fold, Bury, Lancs.—Messrs. C. F. Barrow, A. Barrow, T. Tomlinson, and A. H. Morris have dissolved partnership. Debts will be attended to by Messrs. A. Barrow, T. Tomlinson and A. H. Morris, who will continue the business under the same style.

Trade Announcements.—The telephone number of the OLIVER-PELL CONTROL, LTD., has been changed to "Woolwich 888."

MR. N. J. CHATWIN has commenced business as an electrical engineer and contractor at 7, South Street, Yeovil, and desires to receive price lists, &c.

THE CARWIN ELECTRIC CO. has opened premises at 152, Market Street, Preston.

MR. J. C. WHITE has moved into his new premises at 49, Bridge Street, Deansgate, Manchester.

MESSRS. A. C. ALEXANDRA & CO., of Westminster, have appointed Mr. F. D. Smith as their outside departmental manager for the London area, and Mr. J. L. Turner as departmental manager for the Southern Counties.

MESSRS. ERSKINE, HEAP & CO., LTD., have appointed Mr. Kenneth Hoggan, Needless Alley, New Street, Birmingham, as agent for the Midlands, for the sale of their switchgear. Messrs. T. J. Grainger & Co., Ltd., 31, Side, Newcastle-on-Tyne, are their agents for the North of England, and Mr. James C. Kelso, 128, Hope Street, Glasgow, is agent for Scotland.

Catalogues and Lists.—LOCO & AUTO ECONOMY ACCESSORIES, LTD., 183, Westminster Bridge Road, S.E.1.—Bulletin N. 3, illustrating and describing the "REF" automatic pressure lubricator. Priced.

THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, E.C.4.—A set of uniform folders, Nos. L. 259 to 266, dealing respectively with hall lanterns, dining-room pendants, bedroom pendants, wood pendants, brackets, and standards, wall brackets, drop pendants, standards, and electroliers. All pamphlets are fully illustrated and priced.

MESSRS. MARRYAT & SCOTT, LTD., 28, Hatton Garden, E.C.1.—Revised list of prices of winding engines, controllers, cars, and other lift equipment.

UNDERFEED STOKER CO., LTD., Coventry House, South Place, E.C.2.—An illustrated brochure, dealing with the "Detrick-Usco" suspended arch and comparing it with the sprung arch.

MESSRS. A. GALLENKAMP & CO., LTD., 19-21, Sun Street, Finsbury Square, E.C.2.—A very comprehensive catalogue (574 pp.) of general laboratory apparatus, including a great deal of electrical equipment. Practically every item is illustrated and priced, and the list covers glassware of all descriptions, microscopes, batteries, measurinng instruments, pumps, &c.

MESSRS. COOPER & SMITH, LTD., 110, Cannon Street, E.C.4.—A pamphlet containing illustrations of electric drilling machines, grinders, motors, &c. Priced.

THE LANGHAM ENGINEERING CO., Slough.—A card containing particulars of wire gauges, weights of steel sheet and rod, &c.

MESSRS. FLATHER & CO., LTD., 68, Shoe Lane, E.C.4.—A number of illustrated pamphlets describing a.c. and d.c. motors, and d.c. dynamos.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh (Pa.), U.S.A.—A descriptive pamphlet upon automatic sub-stations for mine service. Fully illustrated.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—A showcard reproducing by a special process a water-colour drawing of a family group before a "Cosmos" fire.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—January stock list of d.c. and a.c. motors, giving net prices.

MESSRS. CHARLES H. SMITH & CO., 277-8, Bank Chambers, 329, High Holborn, W.C.1.—An illustrated folder dealing with the "Glow 6,650" electric grill or boiling ring.

MESSRS. J. & W. B. SMITH, LTD., 15-23, Farringdon Road, E.C.1.—List No. 166, giving illustrations and prices of "Redot" electric fires, bowl fires, irons, kettles, &c.

IGRANIC ELECTRICAL CO., LTD., 147, Queen Victoria Street, E.C.4.—Leaflet No. 1,300, illustrating and describing electric light dimmers for kinemas and small theatres.

Calendars and Diaries.—MESSRS. MOIR & WATTS, of Weardale Road, Lee, S.E.13, have issued a wall calendar with monthly slips beneath an interesting subject in colour.

MESSRS. WILLIAM WHITE & CO., of 13, Sise Lane, Queen Victoria Street, London, E.C.4, have sent us a desk calendar with monthly cards provided with a daily indicator.

MESSRS. ANDERSON, BOYES & CO., LTD., of Flemington Electrical Works, Motherwell, have sent us a wall calendar with monthly slips, above which appears a photographic reproduction showing their chain coal-cutter at work.

From the CITY ELECTRICAL CO., LTD., of Emerald Street, London, W.C., we have received two wall calendars. One is for the complete year, and consists of monthly sheets with large figuring, while the other, for three months, has a coloured picture which will amuse the children.

Industrial Canteens.—A conference on "Industrial Canteens" was held on Wednesday, in the offices of the Industrial Welfare Society, of which H.R.H. the Duke of York is President.

For Sale.—Burnley Corporation electricity department invites offers for one 250-kW Belliss-Dick, Kerr generating set, complete with condensing plant; Halifax Tramways and Electricity Committee has for disposal one 750-kW Belliss engine and Electric Construction Co.'s d.c. dynamo, with a surface condenser.

By direction of the Dunlop Rubber Co., Ltd., Messrs. Edwards, Son & Bigwood will sell by auction, on January 23rd and following days, at Para Mills, Aston Cross, Birmingham, power plant, including a Belliss 1,250-kW turbine, a Siemens 615-kW rotary converter, a turbo-generator, a Brush set, motors, &c.

Messrs. H. Butcher & Co. will sell by auction on February 1st, at 9-13, Hythe Road, Willesden, electric lamp manufacturing and other plant and machinery, miscellaneous stores, &c.; and on January 30th, at the London Auction Mart, the freehold factory and premises will be offered for sale. (See our advertisement columns to-day.)

Correction.—MESSRS. OSLER ask us to point out that through inadvertence a wrong block has been used in their advertisement appearing on page xlvii of this issue. The illustration there shown does not represent a fitting supplied to the London County Hall.

Chicago Orders a 40,000-kW Turbo-Alternator in England.—We are informed that the Commonwealth Edison Company, of Chicago, in order to gain experience of the latest developments in steam turbine practice in this country, has placed an order with Messrs. C. A. Parsons & Co., Newcastle-on-Tyne, for a 40,000-kW turbo-alternator. The 25,000-kW turbo-alternator which the Commonwealth Edison Company ordered from Messrs. C. A. Parsons & Co. in the year 1912 for the Fisk Street station continues to run satisfactorily. The set which has just been ordered is to be installed in the New Crawford Avenue power station, Chicago, of which the designed capacity will be about 500,000 kilowatts, the rest of the plant being probably mainly of American manufacture. The consulting engineers are Messrs. Sargent and Lundy, Chicago, and Merz and McLellan, London.

Book Notices.—"Internal-Combustion Engines," by J. Okell, M.Eng., &c. (pp. 126). London: Sir Isaac Pitman and Sons, Ltd. Price 3s. net.—This volume is one of the publishers' series dealing with common commodities and industries and performs its function well, if, as we take it, the idea is to impart a general knowledge of the subject to those not intimately concerned with the industry. It commences with a brief review of early experiments dating back to those of Murdock, in 1825, leading up to the types of gas-engine in present-day use. These are described generally in the following chapter and an idea of the running costs is given. The next chapter deals, very briefly, with speed control and ignition systems; the high- and low-pressure electrical methods are adequately treated. Chapter IV treats of large gas engines and a number of types are illustrated. The section through a tandem gas engine is on too small a scale to be effective. A short chapter is devoted to a consideration of crude oil, petrol, and benzol. This is followed by a description of the petrol engine, its application to automobiles being the principal consideration, and the next chapter deals with aeroplane engines. A chapter on the vaporisation of petrol and paraffin follows, and later in the book is a section dealing with fuel oils. These and the chapter mentioned previously might have been placed together to form one section, and the same might be said regarding other kindred subjects. The volume also deals with Diesel and semi-Diesel engines, heavy-oil stationary engines, marine oil engines, theoretical and actual thermal efficiency, &c. The comments on gas turbines appear not to take account of experiments subsequent to 1908. The final chapter states the case for the i.c. engine as opposed to the steam engine and turbine. The illustrations are good but not too numerous, which may either be considered an advantage or the reverse.

"Manual of Reinforced Concrete," by C. F. Marsh and W. Dunn (pp. 504). London: Constable & Co., Ltd. Price 21s. net.—The preface to the fourth edition states that, the demand having necessitated a new issue, occasion has been taken to introduce additional matter and to effect various improvements. The portion of the volume dealing with earth pressures on retaining walls has been considerably revised, and Prof. Cain's treatment, taking into account the friction of the earth filling against the back of the wall, has been included. The bending moments in beams with fixed ends receive special treatment and diagrams have been added containing factors for computing bending moments and shearing forces on slabs supported and fixed along various edges. A new section has been inserted dealing with bracketed columns and many other improvements have been made.

"Diesel Engines for Land and Marine Work" by A. P. Chalkley, B.Sc. (with an introductory chapter by the late Dr. Rudolf Diesel) (330 pp.; 165 figs.). (Fifth edition.) London: Constable & Co., Ltd. Price 21s. net.—Since the last edition of this work (1915), the use of the Diesel engine in marine work has increased very considerably, and in consequence the volume of production has experienced a proportionate growth. A work of this nature is therefore of great utility, and its popularity is attested by the fact of its having reached a fifth edition. It has only been necessary to revise the "practical" side of the work, as the theory of the subject has not gone far beyond the stage previously recorded. The salient features of many new designs have been dealt with and a number of additional illustrations included.

"Discoveries and Inventions of the Twentieth Century," by Edward Cressey (458 pp.; 342 figs.). (Second edition.) London: George Routledge & Sons, Ltd. Price 12s. 6d.—As stated in the preface to the first edition, this work does not attempt to chronicle every advance made in science, art, and industry during the first few years of this century, but rather to single out those developments that appear to be of the greatest importance. The rapid progress in many directions brought about by the war and its consequences—to say nothing of the normal forward movement which, after all, the European cataclysm did not altogether arrest—have made the first edition (published in 1914) incomplete. Thus, a great amount of amendment and addition was necessitated, and while some few chapters have been but little altered, the greater part of the book has been re-written. The development of the thermionic valve for radio-telegraphy and telephony and the physics of the subject is one of the many useful additions. A new chapter gives a simple, interesting review of the results of modern chemical research.

Messrs. Johnson & Phillips, Ltd., Charlton, S.E., have published an index to their series of twelve "Transformer Abstracts," which have been noticed in our columns from time to time.

"Elementary Principles of Lighting and Photometry," by J. W. T. Walsh; pp. xvi+220; figs. 85. London: Methuen and Co. Price 10s. 6d. net.

"Arithmetic for Engineers," by C. B. Clapham. Third edition; pp. xiii+491; figs. 174. London: Chapman & Hall, Ltd. Price 7s. 6d. net.

"Industrial Organisation," by J. Lee; pp. viii+123. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

"The *Bulletin* of the Hydro-Electric Power Commission of Ontario." November, 1922. Toronto: The Commission.—In this number the history of the Commission is continued. An article on washing machines is published, and an account of an Association of Municipal Electrical Utilities meeting appears. In the technical section is an article on "The Oscillograph and Some of its Applications."

"The Golden Hammer," by A. W. Marshall. Pp. 188; illustrated. London: Percival Marshall & Co. Price 3s. 6d. net.

"M. & C. Machine Mining," January, 1923. Glasgow: Messrs. Mavor & Coulson, Ltd.—This issue contains details of the construction and use of electrical coal-cutting machines in varied circumstances.

"Telephone Erection and Maintenance," by H. G. White. Third edition. Pp. vii+144; figs. 61. London: S. Rentell and Co., Ltd. Price 3s, 6d. net.

"Post Office Electrical Engineers' Journal. Vol. XV, part 4, January, 1923. London: ELECTRICAL REVIEW, LTD. Price 2s. net.

Our Foreign Trade.—DECEMBER FIGURES.—The following were the values of imports and exports of electrical goods and machinery during December, 1922:—

	Dec. 1922.	Inc. or dec.	12 months 1922. Inc. or dec.
Imports.—	£	£	£
Electrical goods and apparatus	204,558	+ 80,262	− 377,699
Machinery	792,711	+ 271,075	− 2,594,953
Exports.—			
Electrical goods and apparatus	574,360	− 176,391	− 5,733,410
Machinery	4,536,162	− 720,961	−22,881,414
Re-exports.—			
Electrical goods and apparatus	6,862	− 5,028	− 66,172
Machinery	123,125	+ 47,560	− 102,849

Local Exhibitions.—Reporting upon the results obtained from the recent electrical exhibition, the Stoke Newington Electric Lighting Committee states that nine application forms for a supply were signed; five cookers had been sold on the hire-purchase system, apart from one bought directly from the manufacturers; numerous small appliances had been sold by local contractors; and the output of the undertaking had shown an increase of 16 per cent. The exhibition cost £140, and 3,155 visitors attended it.

Employés' Radio Concert.—An opportunity was afforded to a party of nearly 200 of the employés of Messrs. Gent and Co., Ltd., Leicester, and their friends of "listening-in" to the concert transmitted by the British Broadcasting Co., from Birmingham, on the evening of January 10th. The demonstration was particularly interesting to the audience, because of the fact that the receiving set used was the standard type of apparatus manufactured by the firm.

Stocktaking.—At the opening meeting of the new session of the Birmingham and District Electric Club, on Saturday, January 13th, Mr. C. G. A. McDonald delivered his presidential address, "Stock-Taking" being his subject. A large portion of the address was devoted to criticism of the Birmingham electricity department, the generation costs being stated to be higher and the consumption less per head than in other cities of equal rank. The speaker urged those interested in the industry to stimulate the enterprise of the city fathers.

New Italian Companies.—The Società Idroelettrica Alto Timavo has been formed at Milan with a capital of 120,000 lire in 480 shares of 250 lire each.

The Società Anonima Marghine per Industrie Elettriche Macomer is the style of a company just established with a capital of 250,000 lire divided into 250 1,000-lire shares.

There has been embodied at Trasaghis (Udine) the Società Elettrica di Trasaghis, with a capital of 100,000 lire, with the object of generating and distributing electric energy.

With a capital of 1,200,000 lire has been constituted at Venice the Società Anonima Termo Elettrica Umbra, being a reconstruction of the company Miniere di Lignite di Gualdo Cuttaneo.

Lead.—In their report, dated January 13th, Messrs. James Forster & Co. stated: Supplies, as will be seen from the Board of Trade Returns, are fully maintained, other countries making up for the reduction in Australian arrivals.

BOARD OF TRADE RETURNS.

Imports for December	15,223
Exports for December	1,502
Left for home absorption	13,721
Ditto for the 12 months to the end of December	145,194
Ditto monthly average for 1922	12,099
Ditto monthly average for 1921 (including stocks)	10,274

Of the increase of the monthly average for 1922 of "left for home absorption," the trade for domestic lead accounts for roughly 1,000 tons per month, the remainder being, no doubt, absorbed in the electrical trades. Consumers are at the moment fairly well supplied and the market is firm on prospective short supplies rather than on demand.

Guest Keen & Nettlefold's Extensions.—Extensive alterations and developments are to be made at Guest Keen and Nettlefold's works at Dowlais. The contract has already been let for a large new electrical plant, and it is understood that tenders are under consideration for a new set of coke ovens. The work of construction will last over an approximate period of twelve months.—*Financial Times.*

British Trade with China.—The two main features in China's trade with Great Britain are piece goods and engineering. In the latter Great Britain has made rapid strides during 1922; the lowered cost of production at home is responsible for her manufactures in some cases being able to compete in price not only with American but with Japanese goods. Instances are not wanting that in certain cotton mill accessories Japanese competition has been adequately met by British manufacturers. In textile machinery America, which obtained a good hold of the China market during the war years, is now not wholly able to compete with British manufacturers, and in this item in China's import of machinery Great Britain's position is again being re-established. Values only can be taken to gauge the extent of the machinery and engineering trade; but as the ratio of exchange in China as between the foreign powers has not differed to any appreciable extent, values can be taken as an indication and approximation of the trade done, even if they are not minutely accurate. Taking values, therefore, in the seven items which cover the machinery trade with China—*viz.*, machine tools, agricultural, propelling, textile, brewing, other kinds of machinery and electrical material and fittings, Great Britain in 1921 held the lead in four, came second once, and third twice. America held the lead twice, came second four times, and third once. Taking the same in percentages, Great Britain in 1921 held 35.87 per cent. of the machinery trade, America 31.20, Japan 15.12, and Germany 2.12. America's figures show a considerable decrease over 1920, Great Britain's considerable increase. Now, though as stated above, figures are not available for the whole of China, Great Britain's imports of machinery into Shanghai for the first nine months of this year, based on value, were 52.29 per cent., America 25.68 per cent., Japan 9.29 per cent., Germany 7.49 per cent. These figures, though they can only be considered approximate, nevertheless are a fairly reliable indication of the trade of China (in which Hong-Kong is not taken into account) and show the re-establishment of British prestige. Taking the items separately, only once in the past ten years has Great Britain's position in the textile industry in China occupied second place; in machine tools she now leads, also in propelling machinery and other kinds. One cannot forget, however, in considering this market, that Germany is increasing her business, and particularly is this noticeable in electrical power plants, for which there is a growing demand, and in electrical goods. She is helped to a considerable extent by the favourable exchange, though German merchants in China are reluctant to quote in marks, preferring sterling or the American dollar. Nevertheless, it is a competition which is advancing and one in which the British manufacturer could do much more than he is doing, if he were able always to compete in price. At the present time the actual business in spinning machinery is very small though inquiries are numerous, the tendency being for manufacturers in China to devote their attention to the installation of weaving plants, and in this direction there are bright prospects for the British manufacturer. The future is much brighter than it has been for some time, but progress is held in check by the unsettled state of the country. The British manufacturer need not fear much in the future, though his aversion to long credits may cost him a few orders. Instances have come to light in which competitors of British houses in the machinery trade have offered exceptionally long credits, one within the knowledge of the writer, in which the final payment was to date four years after the signing of the contract! Viewed generally, the trade with China has shown some improvement and possibilities during the year, but is severely handicapped by an impotent Government and unsettled provinces.—*Reuter's Trade Service* (Shanghai).

"Coal Debentures" for Hydro-Electrical Works.—A remarkable method for assisting in the financing of extensions of hydro-electric works has been adopted by the Baden Electricity Supply Co. of Carlsruhe, which is an undertaking owned by the State of Baden. Under the guarantee of the State the company is making an issue of "coal debentures" in denominations of 10 tons, 5 tons, 2 tons, 1 ton, and 10 cwt., bearing interest at the rate of 5 per cent. On subscription the purchaser has to pay a sum in paper marks which represents the value of the quantity of coal indicated on the debenture at the date of payment. In reply to criticisms the directors of the company state that although the company does not produce coal, which is the basis of the loan, it generates electricity the value of which is generally calculated according to the value of coal. The Baden company's contracts with customers fix the prices for supply according to the value of a definite quantity of coal. The first instalment of the Murg hydro-electric works, which is already in full operation, has an output of 60,000,000 kWh per annum, which is fully taken up. The price received per kWh corresponds to the value of from 2½ to 3 kilogrammes of coal at the pit, and the 60,000,000 kWh corresponds to 150,000 tons of coal per annum. The cost of the second instalment of the Murg works, which will presumably be completed at the end of this year, will be defrayed out of the proceeds of this coal loan. After being brought into use the works, as enlarged, will be able annually to produce 100,000,000 kWh, or the equivalent of a value of 250,000 tons of coal at the pit. The loan is secured on the Murg works, and both interest and redemption are guaranteed by the State of Baden.

Doubtful Cuban Prospects.—Although Cuban Government officials and business men have at various times professed a desire to promote closer commercial relations with Great Britain, there is not likely to be any considerable movement in that direction. Ample reasons for this appear in the recently-issued Consular report from Havana, which has been published by the Department of Overseas Trade. Cuba has not returned to normal after the crisis of the past two years, and in many respects the market is seriously overstocked. The economic, political and geographical ties with the United States are paramount, and Great Britain's share of the total import trade is about 3.46 per cent. Yet iron and steel imports, such as structural steel, should, in the Consul's opinion, be in demand shortly for repairs and building purposes, while paint, wire, hardware, &c., appear on the manifests of recent arrivals from the United Kingdom. The market for electric elevators, he says, is worth cultivating.

A Practical Demonstration at Hackney.—The new chairman of the Hackney Electricity Committee (Councillor W. Hammer) and his wife are making certain that the Committee, at least, shall know the benefits of electricity. Accordingly they arranged a supper on January 9th to which the Committee was invited, and everything provided was cooked electrically. Even the concluding cigars were electrically lighted, and then the party was shown over the house and shown the "B. & K." cooker, the "Hotpoint" table oven, the "Premier" suction cleaner, the Nobbs water heater, &c.

A Shipping Showcard.—Carron Company has issued a showcard in colours advertising its line of steamships plying between London, Glasgow, Belfast, and other ports.

Copper and Lead Prices.—Messrs. F. Smith & Co. report, January 16th: Copper (electrolytic) bars, £70 15s., 20s. decrease; ditto ditto sheets, no change; ditto ditto wire rods, £80 15s., 20s. decrease; ditto ditto H.C. wire, 10 1-16d., ¼d. decrease.

Messrs. James & Shakespeare report, January 17th: No change in prices for copper bar, sheets and rod and English pig lead.

The South African Electrical Market.—According to a recent report by the Canadian Trade Commissioner at Cape Town, the use of modern electrical appliances is slowly, but surely, gaining ground in South Africa, and the average dealer and prospective dealer is taking a more decided interest in other than the stereotyped patterns of electrical goods. The trade in electric irons is already a large one, and is one of the best selling lines. The insulation should be mica, and not micanite, on account of the frequent changes required in the elements. The bayonet plug is essential. The electric kettle, next to the electric iron, is the most popular selling line. The British one-quart brass-finished type is the one most in evidence. The standard quality of the British element in kettles is always an argument used by the dealer to justify his preference for this product. The electric fan is another good selling article, especially for hotels and offices. The portable kind is most in favour; sales of ceiling fans are limited. The trade in sewing machine motors is increasing. Electric washing machines are so far little used, first on account of the high cost of the installed machine, and secondly, on account of the cheapness of native labour. The opinion is expressed, however, that in the near future there will be an increased demand for such machines. Vacuum cleaners, in spite of the native servant, will also increase in demand. The electric heaters in service are generally of a one- or two-circuit resistance type, most of them being of British manufacture, and of the vertical type. Sales are limited to cities, Durban being so far the most up-to-date place in the matter of both heating and cooking by electricity. The lighting fixtures used in South Africa are generally simple, the most common fixture being a drop-cord unit with a weighted porcelain cord adjuster and a plain shade. The semi-indirect lighting bowls are now finding a readier market, and a better grade of electroliers is coming in, though slowly. The bayonet sockets are ordinarily fitted to the arm of the fixture; key sockets are seldom seen, the practice being to install switches for all outlets, and often to have two switches to split up control of multiple light fixtures, where it may be desired to burn only part of the lamps at times. The switches used in general wiring for lighting are the usual tumbler types, mounted on either a flat or a recessed round wooden base block, the latter being required for the semi-flush design of tumbler switch. Snap and push-button switches are known and liked, but on account of price will not make any headway, and further, all partitions are of solid brick and it makes it expensive to work to place them to advantage. The linked tumbler switch with rectangular single-pole porcelain cut-outs is a common

entrance switch unit. Cartridge fuses are used to a fair extent, but nearly all for motors. Pendant switches are used to some extent. The usual lighting voltage is 220 volts, and the standard wire is the British Cable-Makers' Association, 600 megohm grade, wiring practice being in general the same as that in England. Many farm lighting sets are being supplied from America. A compact semi-automatic, direct-connected set, designed for operation on kerosene and equipped with a magneto, is in demand. The popular size is 32-volt, 0.5 kW sets, with a battery of moderate rating. There is some call for belted units. In dry cells also the Americans are doing much of the trade, though the Danish Hellesen cell holds the best reputation. There is a good demand for flash-lights. There is a small demand for carbon-filament lamps for certain work about the mines. The Trade Commissioner maintains that the ideal method of securing business would be the appointment of a factory representative, say at Johannesburg, with sub-agents at other centres, whom he could visit regularly. Such a representative could act either for one manufacturer or for a group of firms. Almost all firms handling electrical material, or machinery, are already tied up with some representative or other. It is therefore essential that a competent man should be sent out to organise a business and then visit the country every two years or so at least.

The West Indian Market.—Despite the proximity to the American continent there is, according to the report recently issued by the Department of Overseas Trade, a real desire among West Indians to trade with the home country, and this desire has been encouraged by the new preferential duties, by the greater interest of British firms in the West Indian market, and by the adverse American exchange rates. The sale of electrical apparatus is, however, hampered by the fact that most of the installations are American, using American standards. Whilst the British Government has not at present a Trade Commissioner in the West Indies, the office at Trinidad being in charge of a deputy, Mr. A. W. H. Hall, the Canadian Government has established a second Trade Commissioner there, namely, in Jamaica. An increase in Canadian trade with the islands may be expected as a result of these official activities, and of the improved shipping facilities, the visit of the delegation from the Canadian Manufacturers' Association, and other indications of Canadian interest. Canadian trade is strongest in Barbados and the Leeward and Windward Islands. With regard to methods of winning business in manufactured goods, Mr. Hall reiterates the opinion previously expressed that the most satisfactory manner is for a number of manufacturers of non-competing lines to co-operate in sending out a traveller. Imports in 1920 and 1921 were as follows:—

	Total		From United Kingdom		U.S.A.	
	1920	1921	1920	1921	1920	1921
Into	£	£	£	£	£	£
Barbados ...	14,527	11,737	3,579	5,332	9,576	4,808
British Guiana	15,270	13,819	2,692	6,126	11,250	7,450
Jamaica ...	72,692	—	10,090	—	61,007	—
Trinidad ...	23,024	33,446	1,790	3,589	21,079	28,694

New French Companies.—Société des Téléphones Système Picart et Lebas is the style of a company formed at La Boissière, Chateaudun, to work the patents named. The capital is fixed at 3,000,000 fr., and 3,000 500-fr. shares are allotted to the patentees for their rights.

The Société d'Enterprises électro-techniques Du Bourg et Cie. has been formed at Paris (35, Rue du Général Foy) for the formation and working of electrical undertakings. Capital 200,000 fr.

With a capital of 1,500,000 fr. the Compagnie Française des Procédés Emile Haefely at Saint Louis (Haut Rhin), to manufacture electrical machinery has been formed.

The Electric Flow Meter.—Following upon the description of an electrical flow meter which appeared in our issue of January 5th, Messrs. Herbert Green & Co., Ltd., Ruskin Chambers, Scale Lane, Hull, have informed us that they have been supplying these meters for over a year and are at present erecting a factory in Hull for their manufacture. The firm has also sent us a pamphlet showing the application of these meters to the measurement of steam in power plants; a number of large installations are illustrated.

New Belgian Company.—With a capital of 7,500,000 fr. has been launched at Eupen a company styled Manufactures de Câbles Electriques et de Caoutchouc, for the manufacture of rubber and other cables and accessory material and the installation of these. The company takes over another company with a similar name.

British Industries Fair.—The Council of the Birmingham Section of the Fair has issued its first invitations to Castle Bromwich where several hundreds of representative firms in the hardware, metal, and engineering trades have booked space for their exhibits. The Birmingham Section is, of course, the principal part of the Fair so far as engineers are concerned, the London branch being devoted mainly to the "lighter" trades.

Unemployment.—On January 8th the total number of wholly unemployed persons, registered at Employment Exchanges, was 1,473,300. This was a decrease of 12,578 from the previously-recorded figure, and a decrease of 350,433 as compared with January, 1922. The number working short time and drawing part benefits was 53,100 on January 8th, comparing with 56,261 a week previously.

Diesel-Electric Ship Propulsion.—A short time ago there was completed at the yard of the Netherland Shipbuilding Co., Amsterdam, for the Dutch Navy a submarine parent ship with unusual machinery equipment, of which plans are published in the January issue of the *Motor Ship*, from which the following details are abstracted. In the *Pelikaan* the Diesel-electric system of propulsion is adopted for service in the Dutch East Indies. The displacement is 2,600 tons, and the speed about 12 knots. There are electrically-driven anchor windlasses fore and aft. The steering gear is of the electro-hydraulic type, with telemotor control, and the boat-hoist is also coupled to an electric motor.

A considerable amount of electric power is required for the workshop machinery, and it is to be noted that this is supplied not from the main generating sets, but from auxiliary generating machinery. Apart from supplying the current to two 110-h.p. motors driving the torpedo air compressors, and for charging batteries, the main generating sets are only utilised for propulsion. The torpedo charging outfits are particularly large, and could not be dealt with by the auxiliary plant. A Cochran boiler of 20.5 square metres heating surface, working at a pressure of about 200 lb. per sq. in., is installed for supplying distilled water for adding to the batteries and also for heating the oil and other minor purposes.

The main engines comprise two of the M.A.N. high-speed type, developing 700 b.h.p. in six cylinders, running at 290 r.p.m. They are coupled direct to generators of 468 kW at 390 volts and 1,200 amperes. The vessel is a twin-screw craft; each of the electric motors is coupled to a shaft driving a three-bladed propeller, and is capable of developing 550 b.h.p. (taking 1,200 amperes at 380 volts). The speed is 190 r.p.m.

The Ward-Leonard system of transmission is adopted between the generating plant and the motors, and arrangements are such that each generating set can supply power to one motor, or one generating set can, if necessary, be shut down and all the power taken from the other for cruising speed.

The auxiliary generating plant is somewhat unusual. It consists of two Atlas Diesel engines of the four-cylinder type, developing 50 b.h.p. at 550 r.p.m., driving 32-kW generators of 220 volts at 135 amperes which supply power for lighting, driving winches, windlasses, steering gear, and the workshop motors. In addition, there is a 25-h.p. Kromhout hot-bulb engine installed on deck for emergency purposes and coupled to a dynamo that may be used as an auxiliary and for supplying power to the boat hoist.

Applications for British Trade Marks.—Appended is given a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Individuals or firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below. In the case of foreign applications the names and addresses of the representatives in this country to whom the objections are to be sent are also given.

Hémiporogène. No. 430,035. Class 1. A mixture of chemicals for use in electric batteries. Darimont Electric Batteries, Ltd., 536, Salisbury House, London Wall, London, E.C. January 3rd, 1923.

Radiogène. No. 430,036. Class 1. A mixture of chemicals for use in electric batteries. Darimont Electric Batteries, Ltd., 536, Salisbury House, London Wall, London, E.C. January 3rd, 1923.

Sunshine. No. 431,004. Class 6. Electric vacuum cleaning machines, electric washing machines, &c. The Sun Electrical Co., Ltd., 118/120, Charing Cross Road, London, W.C. January 3rd, 1923.

Perophone. No. 421,064. Class 8. Machines for the reproduction of sound and accessories thereof, but not including telephones. Perophone, Ltd., 76-78, City Road, London, E.C.1. January 3rd, 1923.

Tellite. No. 437,031. Class 8. A detecting instrument used for the receipt of wireless telegraphy and telephony. C. F. Elwell, Ltd., Craven House, Kingsway, London, W.C. January 3rd, 1923.

Efescaphone. No. 430,530. Class 8. Wireless apparatus. Falk, Stadelmann & Co., Ltd., 83, Farringdon Road, London, E.C. January 3rd, 1923.

Thermolite. No. 430,603. Class 11. An electric lamp for medical, surgical or curative purposes. H. G. McFaddin and Co., 38, Warren Street, New York, U.S.A. (J. E. Evans-Jackson & Co., 57-60, Holborn Viaduct, London, E.C.) January 3rd, 1923.

Micarta. No. 428,499. Class 50. Electrical insulating sheets and tubes. Westinghouse Electric & Manufacturing Co., 700, Braddock Avenue, East Pittsburgh, U.S.A. (A. S. Cachemaille, 2, Norfolk Street, Strand, London, W.C.) January 3rd, 1923.

LIGHTING AND POWER NOTES.

Accrington.—INSPECTION OF NEW PLANT.—An inspection was made of the new plant at the electricity works, on January 11th, which has recently been erected at an approximate cost of £50,000. The extensions include a 6,000-kW. turbine supplied by the British Thomson-Houston Co., Ltd., bringing the total capacity of the station to 13,000 kW; two new boilers by Messrs. Babcock & Wilcox; condensing plant by Messrs. Hick, Hargreaves & Co.; economisers by Messrs. Green; and a 1,000-kW motor converter by Messrs. Bruce Peebles, Ltd.

Andover.—ELECTRICITY SUPPLY.—The Town Council has approached the War Office with a view to ascertaining if it will extend the cables from the Andover Aerodrome to the borough, and upon what terms.

Ashton-under-Lyne.—PRICE REDUCTIONS.—The Town Council has made the following reductions in the charges for electricity:—Private lighting to 5½d. per kWh, subject to 2½ per cent. discount; power, up to 50 kWh per quarter, 5½d., subject to 2½ per cent. discount, and the following scale, plus 90 per cent.:—First 250 kWh per quarter, 1½d.; next 250, 1½d.; next 500, 1d.; next 1,500, .9d.; next 2,500, .8d.; next 15,000, .7d.; beyond, .6d. per kWh.

Australia.—TASMANIA.—*Hydro-electric Report.*—Mr. J. H. Butters, the Chief Engineer of the Government Hydro-Electric Department, has presented his eighth annual report, covering the year ended June 30th, 1922. He states that during the year the diversion of the Ouse into the Great Lake was completed. The dam at Miena (Great Lake) caused serious delay, as two serious rifts—one 53 ft. deep—were disclosed by the excavations for the foundations. The Waddamana Canal works were completed and made ready for continuous operation. At the power station five turbo-alternator sets were erected and ready for service, but two of them were awaiting the completion of a pipe-line. A new double-circuit transmission line between Waddamana and Risdon, and a single-circuit line between Waddamana and Launceston were erected. The Risdon sub-station was completed ready for formal inauguration. This is the largest sub-station in the Southern Hemisphere having a continuous capacity of 50,000 h.p. The Launceston sub-station was also brought nearly to completion. Work on the Arthur's Lake dam was not proceeded with in view of the disclosure of a site which will modify the scheme, and also of the fact that Launceston will have a surplus of power for a year or two. Mr. Butters complains of difficulty with the staff owing to the inadequacy of the salaries paid. Many important members of the staff have left the service, and Mr. Butters urges that no reductions should be made in the scale of remuneration drawn up by him for the department.

The consolidated profit and loss account showed a net surplus of £15,126, which was sufficient to wipe out a previous accrued deficit and leave £205 to carry forward.

The sales of energy amounted to 79,405,120 kWh—an increase of over 100 per cent. on the 1921 sales. The present prices for energy are: lighting, 5d. per kWh; heating and power, 1d. per kWh; and continuous hot-water supply, ½d. per kWh. Reductions are contemplated.

Birkenhead.—LOAN.—The Corporation has applied to the Electricity Commissioners for sanction to borrow a further sum of £20,000 for mains and services.

Brentwood.—PROPOSED INCREASED CHARGES.—The Brentwood and District Electric Co., Ltd., is applying to the Electricity Commissioners for powers to increase the maximum prices of electricity.

Bury St. Edmunds.—PRICE REDUCTIONS.—The Town Council has made the following reductions in the charges for electricity:—Lighting, from 9½d. to 8d. per kWh, less ½d. per kWh discount for prompt payment; power, a reduction of 15 per cent. on the present charges of 5½d. per kWh up to 500 units; 3½d. from 500 to 2,500; 3½d. from 2,500 to 5,000; 3d. from 5,000 to 10,000; and 2d. beyond.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The development of 50,000 h.p. of electrical energy on the Rivière des Prairies by the damming of the river just below Visitation Island will be started by October next, according to an Order-in-Council which has been passed by the Provincial Government granting, a sixty-year lease on the river rights to the Back River Power Co. The scheme is estimated to cost between six and seven million dollars.—*Reuter's Trade Service* (Quebec).

Carlisle.—LOAN.—The Town Council has applied to the Electricity Commissioners for a loan of £2,900 for mains extensions.

Chichester.—SPECIAL ORDER.—The Town Council has been granted a Special Order authorising the transfer of the Electric Light Co.'s undertaking to the Corporation, and sanction to the necessary loan to carry out the transfer has been obtained

Continental.—BELGIUM.—The Commission recently appointed by the Conseil Provincial of East Flanders to study the question of a general electrification of the province, states that it has nearly completed a scheme whereby the devastated districts will be provided with an electricity supply by the winter of 1923. Communes not situated in the devastated regions will also be supplied. The current will be supplied at high pressure by the province, and the communes will distribute it at low pressure to the consumers.

GERMANY.—The Wurtemberg Diet has decided to guarantee loans amounting to 600,000,000 marks for the completion of four hydro-electric works which are in course of construction, and will be able to yield 70,000,000 kWh per annum. The works were begun with adequate financial means, but the excessive increase in prices has rendered necessary the provision of further funds, which cannot be raised without a State guarantee.

FRANCE.—Application has been made by M. Belleville, of Toulon-sur-Arroux, for a concession to erect a h.p. line to supply a number of communal districts in the departments of Saône-et-Loire and Niévre.

The Société Normande d'Electricité is seeking powers to extend its network to include further districts in the department of Seine Inférieure.

The Société "la Tardoire," of Montbron, department of Charente, has applied for a concession to supply electricity to 10 communes in the department and to three communes in the department of the Dordogne.

Application has been made by the Société des Etudes Saône-et-Marne for a concession to set up a network embracing three departments, including the erection of transmission lines of 15,000 V and 30,000 V.

Ealing.—PRICE REDUCTION.—The Town Council has again reduced the price of electricity by 1d. per kWh.

Kilmaurs (Ayrshire).—ELECTRICITY SUPPLY.—Mr. Bexon, electrical engineer to Kilmarnock Corporation, has asked the permission of the County Council to erect poles in Kilmaurs for the purpose of electric lighting. The scheme will be financed locally.

Maidenhead.—PRICE REDUCTIONS.—The Town Council has reduced the charges for electricity for lighting within the borough from 9½d. to 9d. per kWh, and from 3.35d. to 3d. for power. To consumers outside the borough, the charges for lighting have been reduced from 10d. to 9½d. per kWh, and for power from 4.04d. to 3½d. per kWh. The rate for electricity supplied under contracts has been reduced by 20 per cent., and the charges for public lighting also by 20 per cent.

Manchester.—SHOP-WINDOW ILLUMINATION.—With reference to the paragraph in our last issue bearing the above title, Mr. S. L. Pearce (chief engineer) writes to point out that the charge per kWh is to be 1½d., and not 1½d., as stated.

Mid-Lancashire Electricity District.—LOCAL INQUIRY.—The Electricity Commissioners will hold a local inquiry at the Town Hall, Preston, on February 20th, 1923, at 10.30 a.m. and following days, with reference to the area to be included in the proposed district, the objections and representations which have been made, and to consider (*a*) a scheme which has been submitted jointly by the Corporations of Blackburn and Preston for effecting an improvement of the existing organisation for the supply of electricity in the district and for the formation of a Joint Electricity Authority, and (*b*) a scheme which has been submitted by the North-East Lancashire Electricity Committee for effecting an improvement of the existing organisation for the supply of electricity in the district and for the formation of an Electricity Board.

Northern Ireland.—COOTEHILL (CO. CAVAN).—It has been decided by the local authority to have public electric lighting installed.

DUNMURRAY (CO. ANTRIM).—The Electricity Commissioners for Northern Ireland have made a Special Order authorising the Dunmurray and District Electric Light & Power Co., Ltd., to supply light and power in the district and to use Rahery Mill as a generating station.

Nottingham.—MAINS EXTENSIONS.—Included in the Bill to be introduced into Parliament next session is a scheme for the expenditure of £88,500 for mains, &c.

Oakham.—ELECTRICITY SUPPLY.—The Urban District Council has decided, subject to certain conditions, to offer no objection to the Bill being promoted by the Oakham Gas Co. for the installation of electric lighting in the district.

Portsmouth.—LOAN.—The Town Council has applied to the Electricity Commissioners for a loan of £16,000 for mains, transformers, services, &c.

Port Talbot.—ELECTRICITY ORDER.—The Corporation is applying for an Order to supply electricity for all purposes within its area.

Southampton.—PRICE REDUCTIONS.—The Town Council has reduced the charges for electricity as under:—Lighting, from 6d. to 5d. per kWh; heating and cooking, from 1½d. to 1½d. for the summer quarters only; accumulator charging, from 2d. to 1½d. per kWh.

Staffordshire.—PRICE REDUCTIONS.—The Staffordshire, Worcestershire, and Shropshire Electricity Supply Co. has reduced the charges for electricity for lighting to 6½d. per kWh, and for power to 2½d. per kWh for the first 2,000 kWh per quarter, and 2½d. for the next 8,000 kWh.

South-East Lancashire Electricity Advisory Board.—PRICES FOR BULK SUPPLIES.—At a meeting of the Board, held on January 9th, the question of prices for bulk supplies was discussed. The Board has now determined the principles which should govern the charges to be made by an undertaker when supplying electricity in bulk to another undertaker. The principles are the result of an exhaustive investigation by the Engineering Advisory Committee.

CHADDERTON.—The Urban District Council has applied to the Commissioners for an Order, and at the request of the Council and the Commissioners the Board has declared that the proper source of supply for this district is the Oldham Corporation undertaking.

BARTON-UPON-IRWELL.—The Rural District Council has also applied to the Commissioners for an Order in respect of the townships of Davyhulme (part) and Flixton, and the Board has in this case declared that the proper source of supply is the Barton station of the Manchester Corporation.

WIGAN.—The Board has approved a contract for reciprocal bulk supplies between the Wigan Corporation and the Lancashire Electric Power Co.; also contracts for bulk supplies between the Manchester and Salford Corporations and the Rochdale Corporation and the Milnrow Urban District Council.

HORWICH.—The Urban District Council recently applied to the Commissioners for an Order, and they desired to purchase in bulk from the Bolton Corporation. On the other hand, the Lancashire Electric Power Co. made a competing application for the Order. This matter was also referred to the Board by the Council, the company, and the Commissioners. After a very full investigation the Board recommended that the supplies should be furnished to the Council by the Bolton Corporation, and that the Order should be granted to the Horwich Council.

Swansea.—EXTENSION OF SUPPLY.—The Electricity Committee has recommended the Council to extend its electricity supply to Mumbles, some six miles distant from the centre of the borough, at a cost of £13,505.

ELECTRICITY SUPPLY.—At a recent meeting of the Corporation the borough electrical engineer reported that under the existing agreement with the Corporation the Gorseinon Electric Light Co. obtained a bulk supply of electricity and paid a minimum sum of £3,000 per annum to the Corporation. The area of supply covered by the company's Order of 1910 extends to the parish of Llandilo-Talybont, Loughor and a portion of the parishes of Penderry and Gowerton. The company states that it cannot complete negotiations to supply large consumers because the Corporation charges the same rate as that paid by large consumers in the borough, and has inquired whether the Corporation is prepared to allow such a rebate as will enable the company to develop the area. The borough electrical engineer has recommended that upon the company's extending its plant to develop the area referred to the Corporation, in the special circumstances, undertakes to allow it a rebate of 10 per cent. provided that the existing agreement remains in force until the amount received for current consumption exceeds £3,000 per annum; and that the whole of the supply is obtained from the Corporation.

Torrington.—ELECTRICITY SUPPLY.—The Town Council, after discussing an electric light scheme with a representative of Messrs. Crompton & Co., Ltd., has decided in favour of a joint scheme with Bideford, instead of a separate scheme for the borough.

Wolsingham.—PROPOSED ELECTRICITY SUPPLY.—Having received from the Wolsingham Steelworks an offer to supply electricity for public lighting at 4d. per kWh, subject to a minimum consumption of 10,000 kWh per annum, the Rural District Council has decided, pending confirmation of the offer, to circularise the district with a view to supplying current at 6d. per kWh for power and 8d. per kWh for lighting, this being about 30 per cent. cheaper than the rates at present charged by the gas company.

Watford.—LOANS.—Application is being made to the Electricity Commissioners for sanction to the borrowing of £39,000 for new plant and £44,300 for mains, &c.

TRAMWAY AND RAILWAY NOTES.

Canada.—BRITISH COLUMBIA.—It is announced that the British Columbia Electric Railway Co. will spend $172,000 on new high-pressure lines between Lake Buntzen and Vancouver during the spring.—*Reuter's Trade Service* (Vancouver).

Continental.—SPAIN.—Plans are being prepared for the electrification of the railway between Ripoll and Puigcerda.

ITALY.—Authority has been granted to the Commune of Modena to construct and work an electric tramway from Modena to San Damaso.

Edinburgh.—REDUCED FARES.—The fares on the tramways are to be reduced from January 21st, on which date the electrification of the Marchmont route will be completed.

London.—IMPROVEMENT OF "UNDERGROUND" CARS.—The cars on the District Railway are now being overhauled, and as they come into the repair shops for this purpose many improvements are being carried out. The seats are being re-upholstered throughout, and are being made more comfortable. The poles from floor to roof, which superseded for a time the customary straps, are now being taken out and are being replaced by straps. These are a few of the many improvements which are to be made.

Nottingham.—PARLIAMENTARY BILL.—The Corporation is promoting a Bill to be introduced into Parliament during the forthcoming session for authority to expend £578,370 on various improvement schemes for the city, including £48,000 for the laying of new tramways and the provision of electrical equipment in connection with the scheme.

Sunderland.—TRAMWAY SIDING.—The Town Council has decided to purchase 1,400 sq. yd. of land near the Seaside Lane tramway terminus for the purpose of making a siding to cope with the exceptionally heavy traffic to the seaside in summer time.

TELEGRAPH & TELEPHONE NOTES.

Austria.—RADIO TELEPHONY.—It is stated in Vienna that a branch of Marconi's Wireless Telegraph Co. will shortly be established with a capital of £133,000, of which £40,000 will belong to Austria. The operation of the Austrian branch will be begun next autumn.—*Financial Times.*

Radio Telegraphy.—EFFICIENT TRANSMISSION.—A group of medium power radio stations employing valve transmitters has been erected by Marconi's Wireless Telegraph Co., Ltd., at North Weald, near Ongar, Essex, for the purpose of conducting commercial services with France, Switzerland, and Spain. These stations have been brought to a high state of efficiency and for some months one of them, although only designed for European communication, has been carrying on a Transatlantic service to Canada. One of the other stations (GLO), which is used for communication with Madrid (a distance of about 720 miles), can be heard at Bandoeng, Java, 7,500 miles distance. This fact is reported by the chief of the Bandoeng radio department, whose interest in the Marconi high-speed services from Ongar was aroused by a magazine article. He set out to see if he could hear the signals transmitted by these stations and was successful in receiving the signals from GLO with a two-valve set and an aerial only 45 ft. in length and 15 ft. above the aerth. He reports that signals are audible almost every night in spite of the strong atmospheric disturbances which are common in Java at this season.

India.—RADIO COMMUNICATION.—The question of radio telegraphic communication between India and the United Kingdom is receiving non-official support in India, particularly from commercial bodies, and a number of resolutions on the subject have been tabled for discussion at the forthcoming session of the Indian Legislature. These resolutions include one by Mr. Sethna (Bombay), urging the Government to proceed forthwith in the matter independently, with a view to entering into agreement with a private enterprise, incorporated in India, for the inauguration and maintenance of an efficient service, providing an adequate link in the proposed Imperial scheme, and the working of reciprocal stations in the United Kingdom.—*Reuter.*

The Telephone Service.—HULL UNDERTAKING.—The profit on the Hull Corporation telephone service for the current year ending March is estimated at £10,889, and in the following year an increased profit is foreshadowed. After the reserve fund has been sufficiently replenished, it is hoped to reduce the present tariff, which is already considerably below that of the General Post Office.—*Westminster Gazette.*

United States.—CONFERENCE ON RADIO STANDARDISATION.—The Bureau of Standards of the Department of Commerce which called a conference on radio standardisation, was held on January 12th, 1923, in New York City at the specific request of the following organisations: Institute of Radio Engineers, National Radio Chamber of Commerce, Radio Apparatus Section, Associated Manufacturers of Electrical Supplies, National Retail and Dry Goods Association, American Radio Relay League, and the Radio Corporation of America. Invitations were issued to all the national associations interested in radio standardisation. The representation of radio manufactures was in general through the trade associations of which they are members.

The purpose of the conference was to consider broadly (1) whether a formulation of standards for radio apparatus and service shall be made; (2) if so, what general classes of apparatus or service should be included; and (3) what procedure shall be recommended for carrying out the conclusions reached by the conference. If the conference decides that radio standards should be formulated, it is expected that they may ultimately be adopted, with the approval of the American Engineering Standards Committee, as an American standard. —*T. & T. Age.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia.—MELBOURNE.—Electricity Commissioners. March 31st. Transformers for Morwell power scheme. (January 5th.)
March 15th. Motors, starting and isolating switches. (January 12th.)
April 28th. Transformers and spares. (January 12th.)
Victorian Railway Commissioners. February 28th. Electric train lighting equipment (axle generator system).*
March 14th. Twenty-five dwarf electric signal mechanisms.*
Postmaster-General's Department. February 21st, telegraph apparatus. February 22nd, switchboard parts. March 1st, telephone and telegraph parts. March 16th, telephone and switchboard parts and wires. March 21st, testing and protective apparatus. (See this issue.)

Belfast.—January 23rd. Electricity Department. One 12,500-kW turbo-alternator, with condensing plant and auxiliaries, three 500-kW rotary converters with transformers, l.p. switchgear, &c. (January 5th.)
January 30th. Electricity Department. One electrically-driven centrifugal pump, 18,000 g.p.m. (January 12th.)

Belgium.—February 1st. Municipal authorities of Trois Ponts (Province of Liege). For the concession for the supply of electricity for lighting and power purposes in the town.
February 8th. Municipal authorities of Guygoven (Province of Limbourg). For the concession for the supply of electricity for lighting and power purposes in the town.

Croydon.—January 22nd. Board of Guardians. Repairs and renewals to the X-ray apparatus at the infirmary, or, alternatively, tenders for new up-to-date apparatus. (See this issue.)

Dukinfield.—January 27th. Stalybridge and Dukinfield Joint Sewerage Board. Electric wiring installation for power and lighting at the sewerage disposal works, Bradley Hurst, Dukinfield. Specification (£2 2s.) from Mr. R. Blackmore, generating station, Tame Valley, Stalybridge.

Dundee.—January 19th. Electricity Department. House service meters. (January 5th.)
E.h.p. and l.p. 3-core armoured cable. (January 12th.)

Eastbourne.—February 10th. Electricity Department. Coal suction conveying plant. (January 12th.)

Egypt.—CAIRO.—March 15th. Minister of the Interior. Supply of electrical fittings for 12 months. Director, Personal and Equipment Department, Ministry of the Interior, Cairo.
February 7th. Ministry of the Interior. Stores, including electrical goods, for 12 months for the Prisons Department.*

Gravesend.—January 30th. Electricity Committee. One draught-tube water-tube boiler and accessories. (January 12th.)

London.—CAMBERWELL, S.E.—February 5th. Borough Council. Maintenance of private telephones and electric bells at the Town Hall and other public buildings for 12 months. Mr. F. J. Slater, borough engineer, Town Hall.
BERMONDSEY. — January 29th. Electricity Department. Stores for six months, including cable and jointing material, conduits, meters, electrical accessories, &c. (January 5th.)
ISLINGTON.—January 31st. Electricity Department. Electrical and engineer's stores for 12 months, including cables, meters, transformers, electrical sundries, &c. (January 5th.)
LEWISHAM, S.E.—January 22nd. Board of Guardians. Two electric lifts and machinery, with electrical work, at the hospital. Mr. G. W. Martin, consulting engineer.
ST. GEORGE'S-IN-THE-EAST.—January 25th. Board of Guardians. Installation of electric lighting in the infirmary, Raine Street, E. (January 12th.)
HAMMERSMITH. — January 31st. Electricity Department. Stores (including insulated wire, jointing material, meters, &c.) for 3, 6, or 12 months. (See this issue.)

Manchester. — February 12th. Electricity Committee. 33,000- and 6,600-V switchgear and resistances. (January 12th.)

Meltham.—January 22nd. Electric lighting installation. Co-operative Society, Midway, Meltham, near Huddersfield.

Newport (Mon.). — January 2nd. Electricity Department. One marine-type water-tube boiler, with superheater, economiser, stokers, steam and feed-water pipes, &c. (January 5th.)

New Zealand.—INVERCARGILL.—January 31st. Southland Electric Power Board. Outdoor transformer station equipment for the Monowai hydro-electric development scheme.*

Sidmouth. — January 29th. Urban District Council. Electric lighting scheme. Erection of buildings; plant, including oil engine-driven dynamo, motor booster, switchboard, accumulators, overhead traveller, &c.; overhead mains, house services, &c. (January 5th.)

Skipton.—February 5th. Electricity Department. E.h.p. and l.p. switchgear and transformers. (See this issue.)

South Africa.—JOHANNESBURG.—February 8th. Municipal Council. Tramway spares.*

Stockton-on-Tees. — January 24th. Electricity Department. Supply of 4-core paper-insulated, lead-covered wire-armoured cable. (January 12th.)

Torquay.—February 2nd. Electricity Department. Circulating water pumps, water pipes, and valves. (See this issue.)

Uruguay.—MONTE VIDEO.—February 15th. State Electricity Works. 16,000 metres of coloured cords for internal wiring.*
February 9th. 27,750 metres of 225-V, v.i.r. lead-covered cable.*

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Aberdeen Line.—The tender of the Siemens and English Electric Lamp Co., Ltd., for the supply of electric lamps for the six months ending June 30th, 1923, has been accepted by Messrs. Geo. Thompson & Co., Ltd.

Atherton.—Urban District Council. Accepted:—
Transformers.—Metropolitan-Vickers Electrical Co., Ltd.

Barnes.—Urban District Council. Accepted:—
Turbo-alternator, condenser, and switchgear (£9,088).—English Electric Co., Ltd.
Rotary converter, transformer, and starting switchgear (£2,702).—Mather and Platt, Ltd.

Bolton.—Electricity Committee. Accepted:—
One De Laval centrifugal oil purifier for transformers.—Chadburn's Ship Telegraph Co., Ltd.

Doncaster.—Town Council. Accepted:—
Cables (£1,361).—Callender's Cable & Construction Co., Ltd.
H.p. switchgear, for sub-station.—Ferguson, Pailin, Ltd.
Motors, switchgear, and pumping machinery, for Holmes pumping station (£2,147)).—Gwynne's Engineering Co., Ltd.

Hull.—The City Council has accepted the tender of the Anglo-Belgian Improvements Corporation of £9,236 for the supply of tram rails. The lowest British tender, one from Sheffield, was £5,000 more. The Sheffield Chamber of Commerce wrote urging the retention of the contract in England.

Lexden and Winstree.—Board of Guardians. Accepted:—
Electric lighting installation at the workhouse chapel.—Gosling & Co.

London.—ST. MARYLEBONE.—Electric Supply Committee. Recommended:—
Plant extension scheme.
One 12,500-kW turbo-alternator, with Worthington-Simpson condenser (£45,000).—General Electric Co., Ltd.
Messrs. Worthington-Simpson, Ltd., to be approved as sub-contractors for the supply of the condenser plant.
Or, alternatively,
The tender of the Ateliers de Construction Oerlikon at £39,728 for one 12,500-kW turbo-alternator and condenser, and that Messrs. Worthington-Simpson, Ltd., be approved as sub-contractors for the condenser plant.
Two 60,000-lb. marine-type boilers, with underfeed stokers, &c. (£42,493).—Babcock & Wilcox, Ltd.
Fan-draught cooling tower and tank (£25,500).—Clyne Engineering Co., Ltd.
Rotary converter sets:—
One 1,500-kW rotary-converter set (£5,549).—Met.-Vickers Electrical Co., Ltd.
Three 2,000-kW ditto ditto (£22,365).—General Electric Co., Ltd.

UNDERGROUND ELECTRIC RAILWAYS CO. OF LONDON.—A contract for a 15,000-kW turbo-alternator for Lots Road power station has been placed with the following firms:—Turbine, C. A. Parsons & Co., Ltd.; alternator, Metropolitan-Vickers Electrical Co., Ltd., at a cost of £53,000.

Stafford.—Electricity Committee. Accepted:—
Supply and laying of e.h.p. cable to Messrs. Lotus's factory, Sandon Road (£3,435).—Callender's Cable & Construction Co., Ltd.

Sunderland.—Town Council. Accepted:—
Electric batteries for motor vehicles.—D.P. Battery Co., Ltd., and The Chloride Electrical Storage Co., Ltd.

Torquay.—Town Council.
Rotary converters (£6,177).—British Thomson-Houston Co., Ltd.

Wrexham.—Town Council. Accepted:—
Wiring houses at Acton (£203).—E. O. Walker & Co.

X-Ray Measuring Device.—An "X-ray clock," which its inventor claims will automatically measure and dispense any desired degree of intensity in X-rays, was recently demonstrated before a group of physicians in the laboratories of the St. Francis Hospital in San Francisco. The inventor is Mr. Frank Reiber, and the "X-ray clock" is the third of a set that he has made. In the recent demonstration, radium emanations were first turned upon the sensitive clock and the degree of intensity was gradually increased until the rays were so powerful that they would have withered human flesh. The clock measured the amount of the dosage that was being given off by the X-ray machine that it was attached to.—*Journal of Electricity and Western Industry.*

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, January 20th. At the Royal Technical College. At 7 p.m. Presidential address by Mr. J. Morris, and musical evening.

Association of Engineers-in-Charge.—Saturday, January 20th. At St. Bride's Institute, Ludgate Circus, E.C. At 7.30 p.m. Social and dance.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, January 22nd. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Insulators and Insulating Materials," to be opened by Mr. A. G. Warren.

(Western Centre).—Monday, January 22nd. At the Grand Hotel, Broad Street, Bristol. At 5.30 p.m. Address by the president, Mr. Frank Gill, O.B.E.

(London Students' Section).—Friday, January 26th. Paper on "The Wireless Telephone Service to the Bar Lightship at Liverpool," by Mr. E. A. Payne.

(North-Western Centre).—Tuesday, January 23rd. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Works Production," by Mr. G. H. Nelson.

(South-Midland Centre).—Thursday, January 25th. At the City Council Chamber, Birmingham. At 7 p.m. Joint meeting with the local branches of the Institution of Mechanical Engineers and the Institution of Civil Engineers.

(North-Eastern Centre).—Monday, January 22nd. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Lecture on "Variable-speed a.c. Motors Without Commutators," by Mr. F. Creedy.

Institution of Mechanical Engineers (Graduates' Section).—Monday, January 22nd. At the Institution, Storey's Gate, S.W. At 7 p.m. Informal discussion on "The Value of College Training to Engineers."

Royal Society of Arts.—Wednesday, January 24th. At John Street, Adelphi, W.C. At 8 p.m. Trueman Wood lecture, "The New Methods of Crystal Analysis, and Their Bearing on Pure and Applied Science," by Sir W. H. Bragg, F.R.S.

Nottingham Society of Engineers.—Wednesday, January 24th. At the Welbeck Hotel. At 7.30 p.m. Paper on "Variable Speed Drives from an a.c. Supply," by Mr. H. Cotton.

Greenock Association of Engineers.—Wednesday, January 24th. At 22, West Stewart Street. At 7.45 p.m. Paper on "Sub-station Equipment," by Mr. F. E. Hanford.

Dynamicables.—Wednesday, January 24th. At the Trocadero Restaurant, W. At 7.30 p.m. Dinner. Mr. W. B. Esson in the chair.

Optical Society.—Thursday, January 25th. At the Imperial College of Science and Technology, South Kensington, S.W. At 7.30 p.m. Lecture on "The Birth of Kinematography and its Antecedents," by Mr. W. Day.

Liverpool Engineering Society.—Thursday, January 25th. At the Midland Adelphi Hotel, Liverpool. At 7 p.m. Annual dinner.
Wednesday, January 24th. At the Royal Institution, Colquitt Street. At 8 p.m. Paper on "Wave Transmission of Power," by Mr. W. Dinwoodie.

Chelmsford Engineering Society.—Thursday, January 25th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "The Development of Large Power Stations," by Mr. W. H. Patchell.

Junior Institution of Engineers.—Friday, January 26th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "kVA and its Measurement," by Mr. G. F. Shotter.

Edinburgh Electrical Society.—Friday, January 26th. At the Philosophical Institute. At 8 p.m. Paper on "Internal-combustion Engines," by Mr. J. Hastie.

NOTES.

Carbon Monoxide in Coal Gas.—In the course of an inquest on a man who had committed suicide by inhaling coal gas, Dr. Waldo, the Southwark coroner, remarked upon the danger of the carbon monoxide in this gas. Chronic poisoning by carbon monoxide, although not always detected, was a common occurrence. Flueless gas radiators led to this condition, and he himself had been a victim of it until the gas radiators in the court had been replaced by electric heaters.

He urged that the amount of CO in coal gas for domestic purposes should be reduced, and the jury added a rider to that effect in its verdict.

Accidents.—Last week, at the engineering works of Messrs. Calvert Bros., Folly Hall, Huddersfield, Norman Day (28) received an electric shock which caused him to fall from the roof of a works building to the ground, 25 ft. below. He received serious injuries to his head and back, and was taken to the infirmary in the ambulance, where he was detained.

A serious accident occurred at the Witton Works of the General Electric Co., Ltd., on January 10th. A turbo-generator was under test when it burst and pieces of the machine were hurled in many directions. Seven employés sustained injuries, but only two of them were detained in hospital. The explosion was accompanied by electrical discharges, which started a fire. The flames, however, were quickly extinguished by the City Fire Brigade.

Indian Railway Works.—The new carriage and wagon shops of the G.I.P. Railway at Bombay are well-equipped and extensive. According to the *Indian Importer and Hardware and Ironmongery Gazette* the power plant consists of one 500-kW, one 250-kW, and one 85-kW dynamos driven by high-speed steam engines. Steam is generated by six B. & W. boilers, each capable of evaporating 6,000 lb. of water per hour. The equipment of the smithy, forge, and foundry includes six 7-cwt., one 12-cwt., one 15-cwt., one 20-cwt., and one 40-cwt. steam hammers, an electrically-driven shearing, notching and punching machine, capable of dealing with plates ¾ in. thick, and an electrically-driven bolt-forging machine. In the machine shop there are 27 drilling machines, 24 lathes, 7 screwing machines, and numerous other appliances. There is a great deal of hydraulic equipment, to which water is supplied by electric pumps. One part of a shop is devoted to the care of lighting equipment, and here there is accommodation for storing and charging 1,200 accumulator cells. The charging plant consists of a 30-b.h.p. motor-generator set and a six-panel switchboard.

Lectures.—A series of four lectures on "The Control of the Speed and Power Factor of Induction Motors," will be delivered by Prof. Miles Walker, M.A., D.Sc., under the auspices of the University of London, on February 21st and 26th, and March 14th and 21st. The lectures which will be delivered at the Institution of Electrical Engineers will deal with:—I, Characteristics of the Induction Motor, &c.; II, Various Methods of Changing the Speed; III, The Use of Double and Triple Circuits in Series with the Rotor, &c.; and IV, Phase Advancers, A.C. Exciters, &c.

At the meeting of the Edinburgh Electrical Society, held on January 12th, Mr. A. Whiteley delivered a lecture entitled "Some Wireless Notes." The speaker first traced the development of the Poulsen arc circuit, and described the functions of the component parts of modern transmitting and receiving gear. The applications of frame aerials in direction finding were dealt with. The various types and uses of the thermionic valve were indicated, with special reference to their place in wireless telephony. The lecture was fully illustrated by lantern slides, and at the close members had the opportunity of listening to the London "broadcasting."

Electrically-propelled Ship for Japan.—Due to the very successful performance of the electrically-propelled vessels of the United States Navy, the Imperial Japanese Navy has had the fuel ship *Kamoi* built in the United States and equipped with electric propulsion machinery in order to obtain initial experience with a low-powered ship, as did the United States Navy with the collier *Jupiter*.

The *Kamoi* was built by the New York Shipbuilding Corporation at Camden, N.J. The electrical machinery was furnished by the International General Electric Co. and was built by the General Electric Co. According to the *General Electric Review*, a sufficient number of auxiliaries are driven electrically to give an exceptional heat balance, that is to say, there is just enough auxiliary exhaust steam to heat the boiler feed water. It can be safely stated that she is the most economical steamship of her size afloat, since tests show that she should make her full speed on 0.87 lb. of oil per shaft-horse-power for all purposes, based on 19,000 B.th.u. per pound of oil and a boiler efficiency of 75 per cent.

The *Kamoi* is a 15-knot 20,000-ton 8,000-s.h.p. twin-screw ship with boilers equipped for either coal or oil burning, and the important machinery items are as follows:—

Two 4,000-h.p., 40-pole, 120 r.p.m., 3-phase, 2,300-volt synchronous motors with amortisseur windings especially designed for operation of these motors as induction machines while the ship is being manœuvred

One 6,250-kW unity-power-factor, 2-pole, 2,400 r.p.m., 3-phase, 40 cycle, 2,300-volt generator connected direct to a 10-stage Curtis turbine designed for steam conditions of 250 lb. gauge, 150 deg. F. superheat, 1¼-in. absolute back pressure.

One propulsion control equipment.

Two 400-kW, 3-wire, 110-220-volt d.c. turbine-generator sets for excitation of the main machinery, for driving the electric auxiliaries, and for supplying miscellaneous electrical demands of the ship.

One 625-kW, 2-pole, 1,100 r.p.m., 3-phase, 750-volt, a.c. generator coupled to one of the 400-kW, d.c. generators; to be used for emergency propulsion of the ship up to 55 propeller revolutions, or about seven knots.

This is the first ship to be equipped with synchronous-motor drive where the motors have been designed on a basis of all manœuvring being done on induction-motor characteristics without field excitation, and where the motor fields are energised only for steady running ahead or astern. During the official trials conducted on September 7th and 8th, with the ship going full-speed ahead, the propellers were stopped and the propelling motors synchronised at 40 revolutions astern in 18 seconds. If necessary, this can be done in 15 seconds or less, and demonstrates that the combined motor and generator characteristics will give the same speed of manœuvring as can be obtained with the older induction-motor drive.

The practicability of the 625-kW emergency generator set was also fully demonstrated during the official trials, in that it had sufficient capacity to reverse the ship promptly while it was going ahead at a speed of seven knots

The propelling machinery functioned in such a satisfactory manner during the trials that the ship was immediately accepted by the Imperial Japanese Navy. During the week of September 19th, the Japanese took the ship to sea for several days for training the crew, and operated the machinery without important assistance from the shipbuilder or the electric company.

Harnessing the Tides.—The French Chamber has passed without discussion a Bill for the creation of an experimental tidal electric power station at Aber-Wrach (Finisterre). It is proposed to build a barrier of 150 metres across the estuary,

the top of the barrier being level with the land at either end and four metres above the spring-tide high-water mark. The barrier is to be constructed of a number of huge hollow blocks of reinforced concrete; the centre block, 35 metres long and 22 metres broad, will contain turbines and alternators; on the right-hand side of the barrier a lock will be constructed for the passage of fishing craft. It is thought that, according to the height of the tide, the barrier will dam up from 2,000,000 to 3,000,000 cubic metres of water. The turbines will act whether the tide is going out or coming in, a difference in level between the water inside and outside the barrier being all that is necessary. Only for a short time when the water is at the same level on both sides will the turbines cease working, a difference of 70 centimetres being all that is necessary to set them in motion. Four turbines will be used, and they will drive two alternators. Owing to the fact that the turbines will each furnish from 75 to 1,200 h.p., according to the state of the tide, it has been necessary to evolve some scheme for making the power obtained less irregular. It is proposed to build across the River Diouris, above tide level, a dam which will store 12,000,000 cubic metres of river water, and which even at high water will give the river a fall of eight metres, and at low water a fall of 29 metres. Thus, even at high and low tide the power supplied will be continuous. It is estimated that a maximum of 4,800 h.p. will be furnished by the installation, and the regular production will be 1,600 h.p. It is hoped that the annual production of the power station will be 11 million kWh; the expenditure will probably amount to 20 million francs.

Before any such elaborate scheme is carried out, a series of experiments will doubtless be made, and only if these prove successful will the great power station be erected. This is not the only proposed experiment in the control of tidal force. Plans were submitted some time ago to the Granville Chamber of Commerce by a group of American engineers, backed by American capital, for the purpose of undertaking experiments in the Bay of Saint Michel. These plans provide for the construction of a barrier some 12½ miles long across the bay, and it is estimated that the installation should give six billion kWh annually, worth some 500 million francs per annum.—*Reuter's Trade Service* (Paris).

Amateur Radio Tests.—The results of observations made by amateur owners of radio apparatus in Europe who received messages from American stations during the nights of December 11th-12th and 12th-13th have been made known. The observations form part of definite tests of the present state of development of transatlantic communication. Some of the messages were received outside the hours fixed for the trials. On the first of the two nights British amateurs picked up telegraphic messages from twenty-eight amateurs in America. Six were received outside the hours prescribed for the tests. British amateurs also received one telephonic message from an American amateur whose call signal is 2ZK. Two British amateurs picked up messages from nine out of fifteen American stations from which messages were received by French amateurs. On the night of December 12-13 a message from an American amateur was received by a Swiss amateur at Geneva, and messages from seven American stations were noted by French amateurs at Nice and Orleans. A French amateur at Pantin also received a message from the American station at Newark, near New York.—*The Times.*

Although amateur radio telegraphy and telephony in France have not so rapidly attained popularity as in England, during the last few months great strides have been made and amateur receiving sets now abound. Numerous prizes have been placed at the disposal of the French organising committee by various constructors of apparatus and they will be awarded to the amateurs obtaining the best results, taking into account the installations at their disposal.—*Reuter.*

The Eiffel Tower have given out the latest results of the trans-Atlantic wireless competition, showing that during the night of December 15th-16th, the British amateurs far outdistanced the French radio enthusiasts. The total number of American calls recorded by French amateurs on the following night was 24. During the night of December 17th-18th, 27 American amateurs were heard by one listener in Switzerland, and nine different French amateurs heard 41 Americans on December 18th-19th. The British records for the last three nights are not available.—*Reuter* (Paris).

The Need for Standardisation.—It is an interesting fact that the component parts in a large consignment of German locomotives recently supplied to Russia were made to interchangeable standards, and it is obvious from this that both the purchaser and the manufacturer will benefit very considerably when it comes to the question of replacements; indeed, standardisation is so taking hold of industry in the different countries that, as time moves on, orders from different parts of the world are more and more certain to specify the standards of the country desiring the goods.

The desirability of international understanding and agreement becomes at once apparent, and in the field of electrical engineering the I.E.C. (International Electrotechnical Commission) is endeavouring to set up standards of comparison for electrical machinery which should prove most useful to export trade. International standardisation, however, presents many difficulties, and there was a tendency, prior to the advent of the national standardising bodies, to attempt to impose on industry standards differing considerably from long-established custom. It is not an ideal, the adoption of which would entail sacrifice of capital that manufacturers are unwilling to contemplate, which is wanted, but rather recommendations representing best current practice arrived at through simplification as well as unification. Such standards alone have any prospect of wide adoption.

A survey conducted recently by the Federated American Engineering Societies indicated that great economies were possible through the simplification of lines of manufactured goods. The survey indicated that quite 25 per cent. of the effort, investment, and energy expended by the industries investigated was absolute waste, a considerable proportion of which was said to be due to lack of standardisation. Is there any reason to believe that the industries in this country are in a superior condition from the point of view of industrial efficiency than is the case in America?

Standardisation is, of course, a question of education. Engineers, being in such close and direct contact with the work, recognise its value, but often those in control of large, as well as small, industrial enterprises do not in the least grasp its significance.

The necessity for supporting the organisation financially, especially during these hard times, and not as a charity organisation, but as a business proposition from which an adequate return is expected, seems often to be lost sight of, yet this obviously cannot be too strongly urged.

Experience, however, brings wisdom, and difficulties which abound, as they do, in any problem, individual or national, are to be overcome, not succumbed to; with so much good-will behind this movement it is impossible that it should not fulfil its high mission and eventually become recognised and adequately supported as the centralising influence of every effort towards unification throughout the engineering and allied industries.

Fuel Economy.—Following the report of the Fuel Economy Committee of the Chemistry Section of the British Association, in which it was recommended that local education authorities should help fuel economy by the institution of properly-organised courses of instruction for the lower grades of boiler-house workers, the Education Committee of the Sheffield City Council has adopted, we are informed, the scheme proposed by Mr. Chas. F. Wade, A.M.I.Mech.E., A.M.I.E.E., for the purpose mentioned. The very gratifying result in the number of students obtained is mainly due to the active support of the Sheffield Chamber of Commerce and local manufacturers, many of whom have arranged to pay the fees of any of their employés who are attending the course of twelve lectures which has been arranged.

Swedish Industry.—In the Swedish official report for the quarter ended December, it is stated that the different mechanical trades present some divergences as to employment and general outlook. The number of workers in the industry varied as under:—

		Machine shops.	Electrical industry.	Ship yards.	Total.
1920.	Sept. 1st.	41,600	7,500	10,900	60,000
1921.	July 1st.	21,500	5,000	5,900	32,400
	Oct. 1st.	19,900	4,300	4,700	28,800
1922.	Jan. 1st.	18,900	4,000	4,000	27,000
	April 1st.	17,600	3,600	4,000	25,200
	July 1st.	18,700	3,700	4,000	26,400
	Oct. 1st.	18,400	4,300	3,700	26,400

In July, 1922, about 5,000 employés were working on Russian orders (railway engines), but three months later this number had been reduced to 2,300 on account of cancellations. The electrical industry shows improvement since last spring while the ship-yards still have only one-third of their working strength occupied. It is stated that in the general outlook for the mechanical trades allowance has still to be made for German competition, but in spite of the accelerated depreciation of the mark the difference between Swedish and Continental quotations is gradually diminishing. This fact is attributed largely to production and export conditions in Germany, and also to the sinking wage-level in Sweden.

Some Aspects of the Communication Art.—An address on the above subject was delivered by Mr. F. Gill, Pres.I.E.E., to members of the P.O. Telephone and Telegraph Society, at the Institution of Electrical Engineers on January 15th. Prior to the address the speaker described the successful experiments in transatlantic radio-telephony in which he had participated earlier in the day, stating that that day would be a historic one in the art of communication. The education of the public in the appreciation of the telephone formed the theme of the first part of the address, and to indicate what was being done in this direction by the telephone companies of the United States the speaker exhibited a large number of lantern slides reproducing advertisements published in the Press of the country. Mr. Gill said that each of these advertisements had a definite basic idea behind it. They were de-

signed to court sympathetic consideration from subscribers, to educate the public in the use of the telephone, to attract new subscribers, to obtain capital, &c., and they all appeared to possess the desired quality in a marked degree. Speaking of finance, Mr. Gill said that funds were raised with surprising ease, showing the public confidence in the service. In addition to educating the public, it was necessary also to educate the staff. There was never a period when so many new things were pressing upon the industry, so that it was essential for those engaged in it to keep up their knowledge and efficiency. Referring to international telephony, Mr. Gill dealt with the present unsatisfactory state of communication. He said that communication between two countries was rendered extremely difficult if intermediate countries were involved. He claimed that there was nothing impossible, technically or commercially, in international European communication. It would involve a representative body and uniform control—unco-ordinated concerns could never carry out a successful scheme. While a uniform language might be desirable, the question of languages was not a bar to an international arrangement.

Appointments Vacant.—Lecturer on electrical engineering, £450 to £550, for the Dundee Technical College; maintenance engineer, also chief clerk, for the Worcester Corporation Electricity Works; plumber-jointer, for Hampstead Borough Council Electricity Department; electrical mechanic (£350), for the Government of Somaliland; distributing assistant (£347), for the Hackney Borough Council Electric Supply Department; assistant engineer (£480) and telegraph foreman (£440) for the Government of Nigeria Posts and Telegraph Department; electrician, for King's College Hospital. (See our advertisement pages to-day.)

The British Association.—Among the sectional presidents for the Liverpool meeting of the Association (September 12th to 19th) are the following:—Section A (Mathematics and Physics), Prof. J. C. McLennan; Section B (Chemistry), Prof. F. G. Donnan; Section F (Economics), Sir W. H. Beveridge; Section G (Engineering), Sir Henry Fowler; and Section L (Education), Prof. T. P. Nunn.

The Electrical Contractors' Association (Inc.): New Offices.—On Tuesday last the president, Mr. H. Marryat, and Council of the Association met for the first time in its new home—15, Savoy Street, Strand—which forms part of the building of the Institution of Electrical Engineers. Our congratulations are due to the Association on securing these excellent rooms, overlooking the Thames, and in close range of both the Institution and E.D.A. An informal reception of representatives of the technical Press followed the Council meeting, and in the course of a brief address, Mr. Marryat stated that the Association existed for the service of its members, whom it was constantly assisting in many ways; it was also, through the National Industrial Council, the negotiating body in respect of wages. A cardinal feature of its policy was to oppose municipal trading, particularly contracting and selling, and another of its aims was to regulate the terms on which electrical goods were marketed.

The first president of the Association, Mr. W. R. Rawlings, also made a few remarks, contrasting the discordant views of the members 20 years ago with the solidarity and harmony by which they were characterised nowadays. Splendid work had been done by their secretaries, Mr. Hogan and Mr. L. G. Tate, and by Mr. Marryat, who so ably conducted their journal, the *Electrical Contractor*. He thought that the municipalities now realised the value of the services that the contractors were willing and anxious to give in developing the uses of electricity, and urged that the former should devote their attention to providing an ample supply of electrical energy.

Carrier-current Telephony Over Power Lines.—The American General Electric Co. has succeeded in transmitting the voice over electric power lines operating at 70,000 volts by means of a carrier current. The tests were made over the high-pressure transmission lines connecting the Highland town sub-station of the Pennsylvania Water and Power Co. at Baltimore, with its hydro-electric plant at Holtwood, on the Susquehanna River, a distance of 40 miles. Conversation was carried on under every possible condition that might occur on a power transmission line, such as short circuits, grounding, and broken wires. The voice is received in much the same way as radio broadcast signals. The equipment consists of a detector and two amplifier tubes. Tuning is not necessary, as the wave length and other characteristics are always the same. Since carrier current travels on a wave length of 15,000 metres, it is removed from any possibility of interference from radio broadcasting stations. The 50-watt sets, as tested, are capable of carrying on communications for a distance of 85 miles, but 250-watt sets are being made by the General Electric Co. which will make it possible to extend the distance of communication to 260 miles.—*Reuter's Trade Service.*

Legal.—BRITISH THOMSON-HOUSTON LITIGATION.—In the Chancery Division, before Mr. Justice Sargant, on January 16th, Mr. Moritz moved for judgment in the action of the British Thomson-Houston Co. *v.* The Advance Lamp Co. He said it was a patent action, and judgment was asked for by consent. It was a case in which the patent had been held to be valid. His Lordship gave judgment as asked.

INSTITUTION NOTES.

Institution of Electrical Engineers. — The following arrangements have been made for the remainder of the current session:—

ORDINARY MEETINGS.—February 1st: P. J. Robinson, "The Maintenance of Voltage on a d.c. Distribution System by means of a Fully Automatic Sub-station." February 6th: Annual Dinner. February 15th: J. Rosen, "Some Problems in High-speed Alternators and their Solution." March 1st: Report presented on behalf of the British Electrical Research Association by Messrs. S. W. Melsom and E. Fawssett, on "Permissible Loading of British Standard Paper-Insulated Electric Cables." March 15th: F. Hooper, F.R.I.B.A., and J. W. Beauchamp, "Co-operation between the Architect and the Electrical Engineer." (Joint meeting with the Royal Institute of British Architects.) April 12th. A. G. Warren, lecture on "The X-ray Examination of Materials." April 26th: L. Breach and H. Midgley, "The Drive of Power Station Auxiliaries." May 10th: Dr. J. A. Fleming, F.R.S., the fourteenth Kelvin Lecture, "Problems in Telephony, Solved and Unsolved." May 31st: Annual General Meeting.

WIRELESS SECTION MEETINGS.—February 7th: J. Hollingworth, "The Measurement of the Electric Intensity of Received Radio Signals." (Experimental demonstration.) March 7th: H. Morris-Airey, C.B.E., "Development of High-power Valves." April 11th: Dr. N. W. McLachlan, "Magnetic Drum High-speed Recorder and Key Transmitter." (Experimental demonstration.)

INFORMAL MEETINGS.—January 22nd: Discussion on "Insulators and Insulating Materials." (Opened by Mr. A. G. Warren.) February 5th: Discussion on "The Supply of Steady d.c. for Telephonic and other Purposes." (Opened by Mr. J. Coxon.) February 19th: Discussion on "Esprit de Corps." (Opened by Mr. F. Peake Sexton.) February 26th: Smoking Concert. March 5th: Discussion on "Control in Industry." (Opened by Mr. J. H. Parker.) March 19th: Discussion on "The Need for Co-operation between Electrical Manufacturers and Contractors." (Opened by Mr. H. T. Young and a manufacturer.)

INFORMAL MEETING.—At a meeting of the Informal Section on January 8th, Mr. R. Grierson was in the chair, and Mr. E. W. Moss opened a discussion on "The Protection of Inventions by Letters Patent." He showed the need of a patent law that should be general to the British Empire, and also made the suggestion that an impoverished patentee should have access to the law *in forma pauperis*. He gave the following general advice to inventors: "See that the application is filed as soon as possible. If possible, make no publication before acceptance. See that renewal fees are paid in good time. Generally, beware of patent brokers, so termed. If you find your patent is being infringed be careful not to threaten the infringer. If you have an improvement in your patent be sure it is covered by the specification, or else apply for a new one. Keep careful and separate accounts of moneys expended or received on patents, because, if you have occasion to apply for an extension, you will require these particulars, which are often most expensive to ascertain after a lapse of time." Sixteen members joined in the discussion, and Mr. Moss replied in detail to the points raised.

NORTH-WESTERN CENTRE (*Liverpool Sub-Centre*).—Major A. M. Taylor introduced his scheme for transmission at 100,000/150,000 volts by underground cables to the Sub-Centre at the University on Monday last. His remarks were illustrated by lantern slides and diagrams. A very interesting discussion followed.

NORTH-EASTERN CENTRE (*Students' Section*).—On January 12th a meeting was held in Newcastle, when Mr. J. Bell (Student) read his paper on "The Effect of Reactance in the Design and Performance of Electrical Machines." Mr. W. D. Horsley was in the chair, and opened a very interesting discussion. The next meeting is to be held in the same place at 7.15 p.m. on January 26th, when Mr. Rochester will read his paper on "The Testing of Large Turbo Plant on Site."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

MR. GEORGE FREDERICK PRESTON, C.B.E., who is shortly retiring from the position of Controller of the London Telephone Service, has had a long experience of telephone work both in engineering and organisation. His entry into electrical engineering occurred in the early '80's, when he joined the Metropolitan Brush concern. As the future of electric lighting seemed to be severely hampered by the first of the Electric Lighting Acts, Mr. Preston looked round for something which held out more promise, and chose the telephone industry, entering the service of the London & Globe Co. When the latter was taken over by the United Telephone

Co., Mr. Preston remained on the engineering staff. He later joined the Northern District Telephone Co. as engineer under Mr. C. B. Clay, and worked on the North-East Coast for five years. When the National Co. took over the Northern District Co., Mr. Preston was appointed to take charge of a large district in the Midlands, and subsequently became superintendent of the Southern Province, which included practically the whole of the Southern and Eastern Counties. In 1901 the Post Office decided to commence an independent telephone service for London, in competition with the National Co.'s system, and Mr. Preston was offered, and accepted, the post of general manager. He occupied this position until 1912, when the era of Government ownership commenced, being then appointed Controller of the London Telephone Service—an office which he is now vacating.

Mr. Preston has been a member of the Institution of Electrical Engineers since 1891, and he served with Methuen's Horse in the Bechuanaland Field Force in 1884, in South Africa.

The growth of the London Telephone Service, for which Mr. Preston has been mainly responsible, has been rapid in the last few years. In 1912, when the National Co. was taken over, the P.O. system comprised 30 exchanges serving 77,000 subscribers, and the company served 131,000 subscribers Since 1911, 43 new exchanges have been opened, and 23 more are nearing completion, and there are about 400,000 telephones. It is significant that 65 per cent. of the male staff were on military service during the war, which shows

Miles & Kay] [*London.*

MR. G. F. PRESTON,

Retiring Controller of the London Telephone Service.

how the system was handicapped. One feature of Mr. Preston's work has been the education of the subscriber by various means—a most essential factor in securing efficiency.

Mr. Preston says that the telephone service was progressing in a remarkable way when the war came and arrested development, but he is very optimistic of the future and considers that when arrears of work have been overtaken the country will have one of the finest systems in the world. He admits the superiority of the American service but attributes this, in great part, to the inefficient postal and telegraph services which made people fly to the telephone. In this country the postal and telegraph arrangements have been such that the telephone has not effected so great an improvement in communication as in the United States.

Although Mr. Preston is retiring from the Government service it is not his intention to remain idle, and it is safe to say that his unique experience of telephone administration and working will not have to seek far for an outlet.

Bury Town Council has placed on record its high appreciation of the services rendered during the last twenty-six years by MR. S. J. WATSON, who has been appointed electrical engineer to the Salford Corporation.

We are informed that MR. F. DUTTON has resigned the position of provincial representative to the Sterling Telephone and Electric Co., Ltd.

The Bury (Lancs) Corporation has appointed MR. JOHN STEPHENS to succeed Mr. Potts as the works superintendent.

MR. W. HOWARD WADMORE has resigned his position with the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, to take up an appointment with the A.C.E.C., 56, Victoria Street, London.

MR. R. G. RAWKINS, manager and secretary and a director of the Notting Hill Electric Lighting Co., Ltd., has been appointed a Justice of the Peace for the Royal Borough of Windsor. Mr. Rawkins, who recently underwent an operation for appendicitis, is, we are pleased to hear, now progressing satisfactorily.

At a staff gathering recently MR. G. FULLER, retiring chairman of Messrs. Fullers United Electric Works, Ltd., was presented with an illuminated album containing the names of the subscribers to mark the staff's appreciation of the work he had done during his fifty years with the company.

MR. S. G. WYBROW, who was mentioned as a "provisional director" of the new company—Inventions Developments, Ltd.—on p. 986 of the ELECTRICAL REVIEW for December 29th last, writes to say that he is now merely a subscriber or shareholder of the company.

MR. A. H. DARKER, A.M.I.E.E., chief electrical engineer of Messrs. J. Stone & Co., Ltd., Deptford, London, is leaving London to-day (January 19th) by the P. & O. steamer *Narkunda* on a business trip round the world.

On Sunday an official farewell was given to Mr. J. P. SIMPSON, former engineer and manager of the Preston Corporation tramways, who, by accepting the managership of the electricity undertaking, severs his connection with the department after 17 years. His successor, Mr. H. Clayton, expressed the hope on behalf of the men that Mr. Simpson would meet with success in his new sphere. Councillor J. Woolley, J.P., chairman of the Tramways Committee, presented Mr. Simpson with a cheque as a farewell gift.

Obituary.—MR. G. C. TAYLOR.—We regret to record the death, which occurred on Friday last, January 12th, at Chester, of Mr. George Crossland Taylor, who, together with his brother, Mr. James Taylor, founded the Telegraph Manufacturing Co., of Helsby, which was subsequently amalgamated with the British Insulated Wire Co., Ltd., as the British Insulated and Helsby Cables, Ltd., of Helsby, Prescot, &c. Mr. Taylor was 65 years of age. He was a director of the British Insulated and Helsby Cables, Ltd., the Electric Supply Co. of Victoria, Ltd., the Electric Supply Co. of Western Australia, Ltd., and the Telegraph Manufacturing Co. (Colonial), Ltd.

HERR S. UTZINGER.—The death is announced from Stuttgart, at the age of 60 years, of Herr S. Utzinger, a well-known German electrical engineer. The deceased was associated for over 30 years with Schuckert & Co. and the Siemens-Schuckert works at Charlottenberg. More recently he had been connected with the Bosch Magneto Works, at Stuttgart.

NEW COMPANIES REGISTERED.

Re-Echo Wireless Manufacturing Co., Ltd. (186,876).—Private company. Registered January 4th. Capital, £3,000 in £1 shares. To take over the business of manufacturers of wireless telephony apparatus carried on by S. F. O'Hara and J. B. Bignamy at 16a, Hatton Wall, Hatton Garden, E.C. The first directors are:—S. F. O'Hara, 148, Shaftesbury Avenue, W.2; J. B. Bignamy, 92, Gloucester Street, S.W.1; W. R. Hargroves, "Springmere," Ailsa Road, St. Margarets-on-Thames. Qualification: £50. Registered office: 16a, Hatton Wall, Hatton Garden, E.C.

Dickson & Gow, Ltd. (12,506).—Private company. Registered in Edinburgh January 4th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of wireless telegraph, telephone and electrical instruments, &c. The subscribers (each with 10 shares) are: J. H. Dickson, 14, Eton Place, Glasgow, electrical engineer; J. D. Murdoch, 141, St. Vincent Street, Glasgow, solicitor. The first directors are not named. Solicitor: J. D. Murdoch, 141, St. Vincent Street, Glasgow.

Peto Scott Co., Ltd. (186,902).—Private company. Registered January 5th. Capital, £500 in £1 shares. To adopt an agreement with W. Scott Worthington, and to carry on the business of manufacturers of and dealers in wireless, telegraphic and telephonic apparatus and appliances, &c. The first directors are: W. Scott Worthington, 17, Frome Road, Wood Green, N.22, radio engineer; W. H. Scott Worthington, 37, Queen's Road, Edmonton, N.9, master grocer and provision merchant. Qualification: 10 shares. Solicitors: W. I. Thomas, 33, Chancery Lane, W.C.

Norie, Pelmear and Millet, Ltd. (187,029).—Private company. Registered January 11th. Capital £1,500 in 10s. shares. To adopt an agreement with J. R. D. Norie, and to carry on the business of general, mechanical, constructional and electrical engineers, importers, exporters and manufacturers of and dealers in all kinds of commodities required for engineering purposes, &c. The subscribers (each with one share) are: J. R. D. Norie, 20, Woodstock Avenue, Golders Green, N.W.11, electrical and mechanical engineer; C. B. Millett, 13, Grange Gardens, Eastbourne, merchant. The subscribers are to appoint the first directors. Secretary: H. Crafter. Solicitors: H. Crafter & Co., 35, Bloomsbury Square, W.C.1.

Radio, Phonopore and Electricals, Ltd. (187,061).—Private company. Registered January 12th. Capital, £5,000 in £1 shares. To carry on the business of manufacturers of telegraphic, telephonic, phonoporic and wireless instruments, &c. The first directors are: R. F. W. Robinson (life director), 14, Vicarage Gate, Kensington, W.8; Capt. A. A. Williams, M.B.E. (manager), 4, Haven Green, Ealing, W.5. The said Capt. A. A. Williams shall remain a director so long as he holds £1,000 shares or debentures. Qualification: 50 shares. Remuneration as fixed by the company Secretary: E. G. Yorke. Registered office: 139, Cannon Street, E.C.4.

Residential Wireless, Ltd. (187,062).—Private company. Registered January 12th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers and importers of, dealers in, and agents for the sale, supply, installation, and hire of instruments, apparatus, accessories, appliances and materials capable of being used in connection with radio or wireless telegraphy and telephony, &c. The first directors are: H. Challis-

Sowerby, "The Nook," Swinton Park, Irlams-o'-th'-Height, Manchester, engineer (chairman); G. F. Jones, 104, Gilda Brook Road, Eccles, secretary.

North-East Coast Wireless Co., Ltd. (187,057).—Private company. Registered January 12th. Capital, £1,000 in £1 shares. To acquire the business carried on at Sunderland by H. St. J. Ward, C. F. Westerby, and A. Davison, as the "North-East Coast Wireless Co." The first directors are: W. J. Pickersgill, "Eden House," Newcastle Road, Sunderland, chairman (director, Wm. Pickersgill & Sons, Ltd.); H. St. J. Ward, 1, Dryden Street, Southwick, Sunderland, managing director; C. F. Westerby, 4, Ettrick Grove, Sunderland; A. Davison, 18, Vine Place, Sunderland. Qualification: £150. Remuneration as fixed by the company. Registered office: Blenheim Chambers, High Street, Sunderland.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Simms Motor Units (1920), Ltd.—Issue on December 28th, 1922, of £5,000 debentures, part of a series already registered.

Satisfaction to the extent of £5,000 on December 31st, 1922, of debentures dated April 12th, 1921, and December 28th, 1922, securing £30,000.

Liverpool District Lighting Co., Ltd.—Satisfaction in full on January 1st, 1923, of debentures dated December 24th, 1913, securing £15,000.

Dunn & Co. (Cheltenham), Ltd.—L. Vizard, of Clarence Parade, Cheltenham, was appointed receiver on December 27th, 1922, under powers contained in first debenture dated October 13th, 1922.

C. F. Casella & Co., Ltd. (106,869).—Return dated November 17th, 1922. Capital, £17,000 in 15,000 ordinary and 2,000 preference shares of £1 each; 12,204 ordinary and 2,000 preference shares taken up; £3,504 paid; £10,700 considered as paid. Mortgages and charges: £1,800.

Brown, Boveri & Co., Ltd. (89,167).—Return dated December 14th, 1922. Capital, £50,000 in £5 shares. All shares taken up; £2 10s. per share called up on 8,500 shares; £21,250 paid; £7,500 considered as paid on 1,500 shares. Mortgages and charges: Nil.

Europe and Azores Telegraph Co., Ltd. (39,452).—Return dated October 31st, 1922. Capital, £200,000 in £10 shares. All shares taken up; £144,320 paid; £55,680 considered as paid. Mortgages and charges: Nil.

B.E. Manufacturing Co., Ltd.—J. E. Pritchard, of 115, Colmore Row, Birmingham, ceased to act as receiver or manager on January 3rd, 1923.

Sheerness and District Power and Traction Co., Ltd.—Satisfaction in full on December 4th, 1922, of 4½ per cent. first and 6 per cent. second debenture authorised by resolution of March 7th, 1905, and November 6th, 1913, securing £20,030 and £8,250 respectively.

W. E. Russell & Co., Ltd.—Further charge on certain leasehold premises at St. Annes-on-Sea, dated December 28th, 1922, to secure £1,500. Holders: Huddersfield Building Society, St. Peter's Street, Huddersfield.

Slough and Datchet Electric Supply Co., Ltd.—Deed of security dated December 29th, 1922, to secure £35,000 and covenant to make further advances not exceeding an additional £5,000, charged on certain land and premises at Chalvey, Bucks., and the company's undertaking and property, present and future, including uncalled capital. Holders; Trustees of Clerical, Medical and General Life Assurance Society.

Bell's United Asbestos Co., Ltd.—Particulars filed of £150,000 debentures authorised November 20th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, subject to existing mortgage for £18,800; the amount of the present issue being £100,000.

Lyto, Ltd.—Issue on December 14th, 1922, of £200 debentures, part of a series already registered.

Rely-a-Bell Burglar and Fire Alarm Co., Ltd.—Debenture dated December 20th, 1922, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Thomas Gunn, Ltd., 30, Fore Street, E.C.2.

Stothert & Pitt, Ltd. (74,218).—Return dated October 9th, 1922. Capital, £350,000 in 250,000 ordinary and 100,000 preference shares of £1 each. 191,585 ordinary and 79,788 preference shares taken up. £125,623 paid. £145,750 considered as paid. Mortgages and charges, "£30,000 second debentures issued to bankers to cover any overdraft arising, but this does not exist at present."

H. T. Boothroyd, Ltd. (99,742).—Return dated September 15th, 1922. Capital, £20,000 in 15,000 ordinary and 5,000 preference shares of £1 each. 10,002 ordinary and 2,800 preference shares taken up. £2,802 paid. £10,000 considered as paid. Mortgages and charges, £3,856 5s. 6d.

Scientific Inventions Syndicate, Ltd.—W. A. J. Osborne, of Balfour House, Finsbury Pavement, E.C., was appointed Receiver on January 2nd, 1923, under powers contained in mortgage dated March 16th, 1922.

CITY NOTES.

British Columbia Electric Railway Co., Ltd.

The directors report that the net revenue for the year ended June 30th, 1922, after provision for corporation profits tax, depreciation, sinking fund, and renewals (£182,354) amounted to £409,234. This, with a balance of £24,000 brought forward, made an available total of £433,234. Interest on debentures and debenture stock, and dividends on cum. preference, preferred ordinary, and deferred ordinary stock absorbed £343 478. Of the remainder (£89,756), a final dividend on the preferred ordinary stock at the rate of 18s. 8d. per cent., free of tax (making £4 13s. 8d. per cent. for the year) requires £17,342, and a final dividend on the deferred ordinary stock at the rate of £2 9s. 8d. per cent., free of tax (making £6 4s. 8d. for the year) absorbs £46,142; the balance of £26,276 is carried forward. The report states that, having regard to the difficult conditions obtaining during the year, the results must be considered satisfactory. There has been much unemployment, resulting in greatly decreased traffic; the number of passengers carried fell from 71,065,275 to 69,314,667, while only 321,081 tons of freight was hauled as compared with 413,151 tons in the previous year. On the other hand, the demand for gas continued to increase, and new plant was brought into service at Vancouver and Victoria during the year. The demand for electricity for lighting and power also continued to grow satisfactorily, and in order to meet it the Western Power Co. of Canada, which is owned by the B.C. Railway Co., is raising the dam at Stave Falls for the purpose of installing a fourth set of 7,500-kW capacity. Taxation showed a further increase—from $448,955 to $493,694. With regard to the negotiations for the continuance of the 6-cent fare mentioned in the last report, the directors state that to enable this to be done it was considered necessary to have the company placed under the control of the Dominion Railway Board. Legislation effecting this was sought, but owing to the opposition of the Provincial Government, was not granted Subsequently, however, agreements were entered into with the City of Vancouver, which will permit the 6-cent fare to be charged for a further three years; upon the expiry of this period the matter will be submitted to arbitration. As one of the conditions of this arrangement the company has agreed to reduce its lighting rate in Vancouver from 6 cents to 5 cents per kWh. The Legislature of British Columbia has now passed an Act providing for the regulation of passenger rates chargeable by the company and municipalities, having in view the appointment of a Commission to deal with applications of this nature. The changing of the "rule of the road" from the left to the right will involve the company in an expenditure of about $680,000. Half of this cost will be borne by the State, and 20 per cent. of the estimated cost has been charged against this year's revenue. Mr. Buntzen, who was instrumental in the formation and organisation of the company, died in October last. Mr. Evan-Thomas, one of the retiring directors, is not seeking re-election owing to ill-health. The meeting takes place on Monday next.

Chatham and District Light Railways Co.

For the year ended December, 1922, the revenue was £86,121, and the expenses were £61,833, leaving £24,288. After deducting rent of Rochester Corporation lines, interest, depreciation (£5,000), and writing off cost of the 1921 Act, £13,232 remains, including £599 brought forward. Dividends of 5 per cent. on the preference shares and of 5½ per cent. for the year on the ordinary are paid and £1,325 is carried forward. The revenue showed a decrease of £1,148, and the expenses £6,113, as compared with 1921. The death of Mr. J. F. Nauheim, a director since the inception of the company is referred to in the report.

United River Plate Telephone Co., Ltd.

At an extraordinary general meeting held in London on Tuesday it was resolved to increase the capital to £3,000,000 by the creation of 100,000 new shares of £5 each. Sir Frederick Green, K.B.E., who presided, first mentioned the loss that the company had sustained through the death of Sir John Gavey. Proceeding to explain the necessity that had arisen for the increase in capital, he said that the increased tariffs were conceded by the Government in October, and they had been collected since November 1st. The Government Decree imposed an obligation upon them to satisfy applications for telephone service in the city and suburbs of Buenos Ayres, and that within a year. They were putting forth their maximum efforts to connect all waiting subscribers as quickly as possible. To supply the necessary funds the capital was to be increased as above, which arrangement would enable them to issue one share for every complete multiple of four ordinary shares to existing shareholders, and, following the precedent of previous years, they proposed to issue them at par. Allotment letters would be posted on January 22nd. The chairman also referred to certain important rearrangements which were being made in the company's local administration.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Brompton and Kensington Electricity Supply.—285,465 ordinary shares of £1 each, fully paid, Nos. 1 to 285,465 and fractional certificates.

The undermentioned securities have been ordered to be officially quoted:—

Anglo-Argentine Tramways Co.—110,000 6 per cent. cumulative second preference shares of £5 each, fully paid (Nos. 1,300,001 to 1,410,000).

Italian Companies.—The following Italian companies have increased their capital: Società Idroelettrica Piemontese (Turin), from 40,000,000 to 80,000,000 lire, with power to increase to 120,000,000; Società Elettrica Alta Italia (Turin), from 48,000,000 to 80,000,000 lire and, later to 100,000,000 lire; Società Emiliana di Esercizi Elettrici (Parma), from 14,000,000 to 28,000,000 lire; Società Idroelettrica Alto Noce (Milan), from 100,000 lire to 10,000,000 lire; Società Elettrica Maremmana (Leghorn), from 3,000,000 to 10,000 000 lire; Società Italiana per Imprese Elettriche e Minerarie (Rome), 1,000,000 to 15,000,000 lire—to complete its installation in Umbria; and Società Picena di Elettricità di Fermo (Fermo), 600,000 to 1,500,000 lire.

Shanghai Electric Construction Co., Ltd.—A second interim dividend of 6 per cent., less tax, is announced.

Brazilian Traction, Light and Power Co., Ltd.—A dividend of 1 per cent. on the ordinary stock has been declared.

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE business paints upon an expansive canvas in many of the leading markets. The House has not been so active for several years. It is necessary to go back to the ill-fated boom in over-capitalised industrials in order to find a parallel to the animation prevailing to-day in, *e.g.*, the rubber market, certain mining shares, and even in a few British Government securities. After a day's strife in the effervescence of these pushful markets, a certain violence of detachment is needed in order to drive a calm pen down this column in the very early hours of the morning.

In connection with the lengthening of our lists of quotations, a reader asks whether these lists could not be brought further up-to-date than Tuesday night, seeing that the ELECTRICAL REVIEW appears on Friday. Brief consideration will show that the paper has to be completed on Wednesday; and as Tuesday night's prices, of such shares as those quoted here, are almost invariably those of the following Wednesday morning, this column might as well be headed with the latter day. The Stock Exchange Official List, from which our prices are taken, is dated Tuesday, however, and the matter is mentioned to give a thoroughly clear idea of the reason for what may possibly have raised a mild degree of inquisitiveness in the minds of other readers.

Underground Railway stocks stand out as the main feature of the week, so far as the electrical markets are concerned. The £10 shares of the Underground Railways Company have put on 2s. 6d. at 3 (after being 3½). The "A" shares stand 1s. higher at 8s., and the Income Bonds show a gain of 3 at 90½. Districts are up to 48, a two-point rise, and Metropolitans at 62 are equally advanced. Moreover, the prior-charge stocks of nearly all the Tube Railways are better on the week, and one or two new issues would be received with satisfaction by this department, so short is the supply of present stock becoming. Marconis have come to the front again, by reason of the steady advance in the broadcasting hobby. Boys go back to school this week, but they have infected parents with lively interest in the new system, and the listening-in habit is likely to gain much from the experience of the first circle of experimentalists. Marconi ordinary are ½ up to 2⅜, and the debentures, now fully paid, stand at 105½, which is 6½ premium above the issue price. Canadian Marconis hardened to 11s. 6d.

Several of the stocks and shares in the Eastern cable group are ex dividend, but the scarcity of stock is as marked as ever, and prices are extremely well maintained. The Anglo-American stocks are also ex dividend, the deferred being now quoted at 22¾. Amongst the manufacturing shares, Siemens, after being 21s. 9d., lost the pence and eased off to a guinea. There is, however, a fair amount of support for the shares. Lively interest is taken in what are likely to be the dividends on English Electrics and General Electrics.

The Brazilian Traction Co. has declared the usual quarterly dividend of 1 per cent., and on this the common shares strengthened to 48, the preferred to 89½. Anglo-Argentine Tramways second preference are now quoted 3½ ex all. The "all" refers to the 22 per cent. arrears of dividend which have just been distributed as preference shares, the rate on which has been raised, of course, to 6 per cent. Old and new shares rank equally. The latter, having been distributed by another company, are not subject to income tax. Of the British stocks, London & Suburban preference hardened to 10s. 6d., and London United Tramway debenture to 62. British Electric Tractions have not moved.

In the list of electricity supply shares, Metropolitans hardened to 6½, though this nominal quotation is really too low, because buyers had to give 6 11/16 to-day, Tuesday. City of London strengthened to 2½, and Charing Cross ordinary to 7⅞. Westminsters are 5s. higher at 8½. The new Brompton ordinary are being dealt in on the basis of 28s. to 30s., but have not yet made their appearance in the Stock Exchange Official List, the quotation being removed altogether for the time being, although, of course, it will be reinstituted as soon as necessary formalities are completed.

English Electric 6 per cent. preference rose sharply to £1, and Electric Construction preference are better at 22s. 6d. Cromptons have strengthened to 16s. 3d., and British Aluminiums put on a florin at 18s. On the other hand, British Insulated lost their rise of last week. Callender's & Henley's retain their recent advances.

The rubber market has been booming. A fresh rise in the price of the material added fuel to the flame already kindled, and prices went ahead hand over fist. The pace, indeed, proved too hot to last, and something of a reaction occurred from the best. Iron and steel shares are generally firm, with prices on the up grade. Vickers rose to 17s. 6d. before they subsided to 17s. sellers. The general tendency of industrials is good, and, with the Stock Exchange enjoying more activity than it has done for many days past, the price of Stock Exchange shares themselves has risen to 102, for the shares credited with £25 paid.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Jan. 16, 1923.	Rise or fall.	Yield p.c.
Brompton Ordinary	12	12	29/-†	—	£4 2 9
Charing Cross Ordinary	8	9	7⅞	+ ⅛	5 16 2
do. do. do. 4½ Pref.... ...	4½	4½	4⅞	—	5 7 5
Chelsea	6	6	6¾	—	4 9 0
City of London	14	14	2½	+ 1/16	6 4 5
do. do. 6 per cent. Pref. ...	6	6	23/-	—	5 4 4
County of London	8	8	1⅞	—	5 2 5
do. do. 6 per cent. Pref. ...	6	6	1½	—	5 4 4
Edmundson's Ordinary	Nil	Nil	2½	—	Nil
do 6 per cent. Pref. ...	6/-	12/-	4¾xd	+ ⅛	6 17 2
Kensington Ordinary	9	10	8	—	6 5 0
London Electric	2½	4	8	—	4 0 0
do. do. 6 per cent. Pref. ...	6	6	5½	—	5 17 1
Metropolitan	7	7	6¾	+ ⅛	5 7 8
do. 4½ per cent. Pref. ...	4½	4½	4⅛	+ 1/16	5 10 9
Newcastle-on-Tyne Ordinary	8	Nil	1/16	—	Nil
do 5 per cent. Pref. ...	5	5	15/9	—	6 7 0
do 7 per cent. Pref. ...	—	7	22/-	—	6 7 3
Notting Hill, 6 per cent. Pref. ...	6	6	9	—	6 13 4
North Met. Elec., 6 per cent. Pref. ...	6	6	1⅛	—	5 13 0
Urban Ordinary	Nil	Nil	1½	—	Nil
do 5 per cent. Pref. ...	2½	2½	4	—	6 5 0
St. James' and Pall Mall	12	12	9½	—	6 6 4
South London	7	7	4⅜	—	5 18 0
South Metropolitan Pref.	7	7	1⅛	—	5 18 0
Westminster Ordinary	10	10	8½	+ ½	6 8 0
Whitehall Elec. Inst., 7½ per cent. Pf.	—	7½	17/6	—	8 11 6

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	6	6	103xd	—	5 16 6
do. Def.	1½	34/6	22⅞	—	6 11 2
Chile Telephone	6	6	8½xd	—	4 16 0
Cuba Sub. Ord.	7	7	7⅞	—	9 0 8
Eastern Extension	10	10	19xd	—	5 5 3
Eastern Tel. Ord.	10	10	189½xd	—	5 5 6
Globe Tel. and T. Ord.	10	10	19½	—	5 5 0
do. do. Pref.	6	6	11½	—	5 6 8
Great Northern Tel.	24	22	28⅝	—	7 15 0
Indo-European	10	10	35½	—	7 1 0
Marconi...	25	15	2⅜	+ 3/16	6 6 4
Oriental Telephone Ord.	12	12	2⅞	—	*5 4 0
United R. Plate Tel.	8	8	7	—	*5 14 4
West India and Panama	Nil	Nil	7/6	—	Nil
Western Telegraph	10	10	18⅝	—	*5 6 8

HOME RAILS.

Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	62	+2	8 12 7
do. District	Nil	1	48	+2	2 1 8
Underground Electric Ordinary... ...	Nil	Nil	3	+ ½	Nil
do. do. "A"	Nil	Nil	8/-	+1/-	Nil
do. do. Income	2	4	90½	+3	*4 18 5

HOME AND FOREIGN TRAMS, &C.

Anglo-Arg. Trams. First Pref.	5½	12½	8⅜	—	7 11 9
do. do. 2nd Pref.	Nil	5½	3½	—	8 11 6
do. do. 5 per cent. Deb. ...	5	5	80½	—	6 2 8
British Electric Traction Ordinary ...	4½	—	64	—	7 0 8
do 6 per cent. Pref. ...	6	6	94	—	6 7 8
Brazil Tractions	Nil	Nil	48	+ ½	8 6 8
British Columbia Elec. Rly. Pcc. ...	5	5	76½xd	—	6 7 5
do. do. Preferred ...	5	92/-	76½	—	*6 8 6
do. do. Deferred ...	3	134/-	87½	—	*7 0
do. do. Deb.	4½	4½	78½	—	5 8
Lond. and Sub. Trac., 5 per cent. Pf.....	2½	3½	10/6	+6d.	6 13
London United Tram deb.	4	4	62	+ ½	6 9 1
Mexico Tram. 5 per cent. Bonds ...	Nil	Nil	81½	—	6 2 8
do. 6 per cent. Bonds ...	Nil	Nil	69½	—	Nil
Mexican Light Common...	Nil	Nil	21½	—	Nil
do. Pref.	Nil	Nil	51½	—	Nil
do. 1st Bonds.	Nil	6	67	—	7 8 2

MANUFACTURING COMPANIES.

Babcock & Wilcox	15	15	8½	—	4 11 6
British Aluminium Ord.	10	5	18/3	+2/-	5 9 7
British Insulated Ord.	15	15	2⅜	+ 1/16	6 6 4
Callenders	15	15	2¼	—	6 13 4
do. 6½ Pref....	6½	6½	1⅛	—	5 15 7
Crompton Ord.	10	5	16/8	+ 1/16	6 8 1
Edison-Swan	10	Nil	2/6	—	Nil.
do. do. 5 per cent. Deb.	5	5	63	—	7 18 9
Electric Construction	10	10	1⅜	—	7 5 6
English Electric	8	5	17/3	—	6 16 0
do. do. Pref.	6	6	1	+1/9	6 0 0
Gen. Elec. Pref.	6½	6½	21/9	—	5 19 6
do. Ord.	10	5	1	—	5 0 0
Henley	15	15	2⅜	—	6 6 4
do. 4½ Pref.	4½	4½	4⅜	—	5 2 10
India-Rubber	10	—	11/3	—	—
Met.-Vickers Pref.	8	8	2⅞	—	6 11 2
Siemens Ord.	10	10	21/-	—	Nil.
Telegraph Con.	20	20	25½	—	*4 11 6

* Dividends paid free of Income Tax.
† New shares.

BRITISH TRADE WITH CANADA.

The Question of Branch Works.

THE Department of Overseas Trade has issued a report (price 2s. 3d.), revised to September, 1922, on the financial, industrial, and commercial conditions of Canada, by Mr. G. T. Milne, the retiring Senior Trade Commissioner.

To the electrical engineer one of the most interesting sections of the Trade Commissioner's report will be that dealing with the Dominion's hydro-electric power. It is aptly described as a non-wasting asset, the development of which is contributing in a notable degree to the general progress of the country and to the utilisation of raw materials in manufactures of various kinds.

According to the latest information, the amount of water power in the Dominion, of which a record exists, is 18,255,000 h.p. Of this amount, about two and one-half million horse power has been developed. During the fiscal year 1920-21, notwithstanding the high cost of construction, the total hydro-electric power installed, or under construction, represented 560,000 h.p. of initial capacity. It is officially estimated that, should the rate of water-wheel installation during the past 15 years be maintained, there will be installed in 1925 3,360,000 h.p.; in 1930, 4,110,000 h.p.; and so on progressively till, in 1940, there may be an installation totalling 5,600,000 h.p. At the annual convention of the Canadian Electric Association, held at Ottawa in June last, the President of the Association stated that 200,000 h.p. was being developed annually in the Dominion as the result of harnessing the water powers. This means a capital outlay of $40,000,000 per annum. According to a report recently issued by the Dominion Water Power Branch before referred to, the water power development in the Dominion now represents an investment of $530,000,000. If the rate of progress during the past 15 years be maintained, the investment will probably total $1,000,000,000 in 1940. The existing development represents a power equivalent of 20,500,000 tons of coal annually.

British Sales Opportunities.

In connection with the foregoing developments, there should surely be opportunities for British sales of motors, lighting equipment and accessories, in addition to the many items of electrical gear which come into use in a neighbourhood where cheap current abounds.

Western Canada is, and is likely to remain a particularly good customer for the products of other areas and countries. Mechanical equipment for the farm and electrical appliances, both domestic and industrial, are quoted by Mr. Milne as instances of lines for which there is an extensive and growing demand, met at present almost exclusively by Canadian and United States manufacturers who carry stocks at convenient points in the West in readiness for immediate delivery.

The cost to the United Kingdom manufacturer in carrying his products in stock in, say, Winnipeg, would not be excessive, and in Mr. Milne's opinion would be more than offset by the increased business obtained due to immediate deliveries being possible to the local jobber or retail merchant, as the case might be. In household electrical appliances, electric motors, agricultural machinery, small farm engines of the stationary type, farm electric lighting sets, and so forth, it would appear necessary for the United Kingdom manufacturer to form his own sales and distributing organisation in Western Canada and sell direct to the trade or consumer.

To Import or Manufacture Locally.

In studying how best to cater to the requirements of the Canadian market, we are again told that the British manufacturer should carefully consider the advisability of starting a branch factory. He has heard much about this in recent months. Certain British industrialists have made attempts. Some have proved successful, other only partially so. Hundreds of American firms are already well established. On the whole it cannot be said that our endeavours have come out so profitably as those of United States firms. Proximity, combined with the similarity of conditions across the border, accounts for the advantageous position enjoyed in the Dominion by our American rivals.

A slightly different aspect of the situation is revealed in the following comment, quoted by Mr. Milne, of a prominent Canadian capitalist:—"The United States manufacturer regards a branch factory in a foreign country, whether in Canada or Europe, as a decentralised portion, but still a unit of the organisation. As such, the branch is subject to the same rigid inspection and management as the main or parent concern, and has therefore been a source of profit in a great majority of cases. The British manufacturer, on the other hand, looks upon the branch as a foreign investment, an agency which will detract from the business of the home plant, and, for this reason, not a particularly desirable form of expansion."

If the view of the average British firm in reality be that a branch works will necessarily detract from the business of the home plant, and is therefore not particularly desirable, it may happen that an investigation on the spot may conceivably lead to a truer appreciation of the situation. In matters of this kind wide generalisations should be accepted with caution, as no two cases are parallel.

As to which particular branches of industry it might be advisable for British firms to investigate with the view of making a decision regarding the establishment of branch works, Mr. Milne naturally does not commit himself. The suggestions he makes are only general in character, and firms of manufacturers exporting to the Dominion can decide individually whether, in the light of their experience, the matter is of sufficient interest to justify an investigation. Although nearly 700 branches of American factories, handling a wide variety of products, have been established in Canada, and the number is certainly increasing, there are very many firms in the United Kingdom who would gain immensely if they carried out an investigation, even if they decided against the establishment of branch works. They would at least obtain what, after all, is the one main essential for firms exporting to the Dominion, *viz.*, first-hand information regarding difficulties in the way of selling their particular product, and as to the form their overseas representation must take, if a reasonable measure of success is expected. Mr. Milne expresses the opinion that no better means for the development of our trade with the Dominion can be suggested than by the visits of delegations representative of different branches of industry (similar to that made last winter to Canada and the United States by members of the Scottish Woollen Trades Mark Association), or by those responsible for the selling policy of individual firms.

H.M. Trade Commissioner says that probably the most satisfactory method is for the home firm to register a company under a Canadian charter, securing to itself adequate representation on the Canadian Board of Directors, and thus to some extent sharing in the framing and direction of policy.

Question of Reciprocity.

One of the reasons prompting American firms to open branch factories in the Dominion is to enable them to overcome the Canadian tariff, and take fuller advantage of the growing Canadian market. Another reason is to enable the products of the branch factory to enjoy the benefits of the preferential tariffs operative in various parts of the Empire. In some instances the object is to secure a supply of raw or semi-finished material for a finishing factory in the United States (as in the case of wood pulp supplies for American paper mills). In many cases, United States firms establish merely assembling plants, the component parts of the finished product being imported from the parent factory and assembled in the Dominion. As a rule, these parts enter Canada either free of duty, or at a lower rate of duty than that applied to the finished product, while the Customs regulations make provision for drawbacks of 99 per cent. of duties on imported materials used in the manufacture of articles which are subsequently exported. The drawback is allowable whether or not the material is purchased directly or purchased duty-paid from other importers.

IMPORTS AND EXPORTS.

THE following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ending March 31st, 1922, are taken from the recently-issued trade statistics. Figures for the year 1920-21 are given for purposes of comparison, and notes of any increases or decreases have been added:—

IMPORTS.

		1920-21	1921-22	Inc. or dec.
Copper wire, plain, tinned, or plated.—				
Total ...	lb.	432,000	84,000	– 348,000
	$	159,000	21,000	– 138,000
From United Kingdom	lb.	181,000	5,000	– 176,000
	$	94,000	2,000	– 92,000
,, United States	lb.	251,000	79,000	– 172,000
	$	65,000	19,000	– 46,000
Copper wire, covered, including cable.—				
Total ...	$	302,000	197,000	– 105,000
From United Kingdom		64,000	16,000	– 48,000
,, United States...		238,000	181,000	– 57,000
Electric batteries, primary.—				
Total (mainly from U.S.A.)		65,000	44,000	– 21,000
Electric batteries, primary.—				
Total (mainly from U.S.A.)	No.	89,000	25,000	– 64,000
	$	1,364,000	803,000	– 561,000

		1920-21	1921-22	Inc. or dec.
Electric cooking and heating apparatus.—				
Total ...	$	130,000	83,000	– 47,000
From United Kingdom		2,000	1,000	– 1,000
,, United States...		128,000	82,000	– 46,000
Dynamos and generators.—				
Total ...	$	1,324,000	1,357,000	+ 33,000
From United Kingdom		94,000	38,000	– 56,000
,, United States...		1,227,000	1,313,000	+ 86,000
Electric light fixtures.—				
Total ...	$	668,000	409,000	– 259,000
From United Kingdom		6,000	8,000	+ 2,000
,, United States...		651,000	386,000	– 265,000
Electric meters.—				
Total ...	$	377,000	239,000	– 138,000
From United Kingdom		25,000	66,000	+ 41,000
,, United States...		352,000	172,000	– 180,000
Arc lamps.—				
Total (mainly from U.S.A.)	$	29,000	24,000	– 5,000
Incandescent lamps.—				
Total ...	No.	5,047,000	3,197,000	– 1,850,000
	$	1,185,000	576,000	– 609,000
From United Kingdom	No.	52,000	235,000	+ 183,000
	$	9,000	30,000	+ 21,000
,, United States...	No.	3,373,000	801,000	– 2,572,000
	$	970,000	173,000	– 797,000
,, Japan ...	No.	777,000	510,000	– 267,000
	$	59,000	36,000	– 23,000
,, Holland ...	No.	833,000	1,292,000	+ 459,000
	$	142,000	241,000	+ 99,000
Electric motors.—				
Total ...	$	2,629,000	1,753,000	– 876,000
From United Kingdom		41,000	219,000	+ 178,000
,, United States		2,579,000	1,530,000	– 1,049,000
Self-contained lighting sets.—				
Total (mainly from U.S.A.)		*	143,000	—
Sockets.—				
Total (mainly from U.S.A.)	$	304,000	80,000	– 224,000
Telegraph instruments.—				
Total ...	$	121,000	137,000	+ 16,000
From United Kingdom		41,000	78,000	+ 37,000
,, United States		77,000	59,000	– 18,000
Telephone instruments.—				
Total ...	$	922,000	585,000	– 337,000
From United Kingdom		33,000	3,000	– 30,000
,, United States		889,000	579,000	– 310,000

		1920-21	1921-22	Inc. or dec.
Transformers.—				
Total ...	$	167,000	227,000	+ 60,000
From United Kingdom		—	4,000	+ 4,000
,, United States...		167,000	223,000	+ 56,000
Electrical apparatus, n.o.e.—				
Total ...	$	7,633,000	4,438,000	– 3,195,000
From United Kingdom		313,000	111,000	– 202,000
,, United States...		7,297,000	4,310,000	– 2,987,000
Steam engines.—				
Total ...	No.	157	73	– 84
	$	505,000	213,000	– 292,000
From United States	No.	144	68	– 76
	$	444,000	184,000	– 260,000
EXPORTS.				
Batteries, telegraph and telephone apparatus.—				
Total ...	$	39,000	39,000	—
To United Kingdom...		4,500	4,500	—
,, United States ...		10,000	14,000	+ 4,000
,, Newfoundland ...		16,000	8,000	– 8,000
Dynamos, generators, and motors.—				
Total ...		94,000	56,000	– 38,000
To United Kingdom...		13,000	1,000	– 12,000
,, United States ...		68,000	17,000	– 51,000
Electric cooking and heating devices.—				
Total ...	$	*	28,000	—
To United Kingdom ...		*	2,000	—
,, New Zealand ...		*	6,000	—
,, Australia ...		*	12,000	—
,, Newfoundland ...		*	3,000	—
Electric apparatus, n.o.e.—				
Total ...	$	*	362,000	—
To United Kingdom...		*	145,000	—
,, Australia		*	15,000	—
,, New Zealand ...		*	54,000	—
,, Newfoundland ...		*	11,000	—
,, United States ...		*	66,000	—
Copper wire and cable, insulated.—				
Total ...	$	566,000	440,000	– 126,000
To United Kingdom...		25,000	5,000	– 20,000
,, United States ...		18,000	105,000	+ 87,000
,, Brazil		155,000	152,000	– 3,000
,, British S. Africa...		117,000	122,000	+ 5,000
,, Newfoundland ...		65,000	7,000	– 58,000
,, New Zealand ...		65,000	2,000	– 63,000
Mica.—				
Totals ...	$	660,000	230,000	– 430,000
To United Kingdom...		45,000	22,000	– 23,000
,, United States ...		611,000	205,000	– 406,000

*Not shown separately.

ELECTRICITY IN RUSSIA.

Its Recent Past, Its Present, and its Prospects.

DURING the past five years, says an article in the *Ekonomitchiskaya Zhisn*, success has marked the story of the electrical industry in Russia, both as to provision of materials and production and application of current. It is known that electricity has already penetrated into the darkest corners of the Republic; that notwithstanding the blockade and many wars, the supply of electricity has found almost its pre-war level. By way of the combination and "regionalisation" of the industry a better result has been obtained from the plant at the stations, and in spite of the reduced state of the country, fresh district stations have been enabled to start—the Utkin factory, the Kaschirski, the Kossuyu Goru and the Schatur, besides enlarging the Volchoff works.

One of the difficulties that met the extension of the electric systems of the old times was the varied land interests on which they trenched. The Revolution, by appropriating the land, solved that trouble at one stroke, *i.e.*, by the Government's becoming sole owner. No such troubles arose, for example, in installing the transmission line between Kaschirsk and Moscow and the grouping of the power stations of Moscow and Petrograd; these could hardly have been effected with numerous private interests to overcome or reconcile.

Now that district stations are built according to plan, the fuel question is handled systematically. If progress is slow it is constant. To assure economy and efficiency the decree of December 21st, 1921, on the electrification of Russia, which was adopted by the Eighth Congress of Soviets, requires the combination of the whole electrical industry, including supplies, under one special controlling authority. Of all the problems involved in the matter of electricity after the Revolution, combination and "departmentation" was the most difficult. Local jealousies, traditions, and interests were very prominent, in many cases being legacies of Tsarist times. But V. Levy, a worker, commenting on the situation, looks on the past five years as having, in electricity, laid the foundation of a revival of the country's political economy, and the unification of the electrical factor as indispensable to an efficient well-planned execution.

M. Goelro said at the Eighth Congress of the Soviets: "Had we refrained from electrifying Russia from above she would have been electrified from below." This is quoted in a review of the progress of electricity in Russia since the Revolution, in which the advantages of nationalisation are briefly set out and the progress of the work is dealt with in some detail.

Seven regional stations are being constructed in the land of the Russian Soviet Republic: one hydro-electric, three peat, and three coal stations. Three of these stations—two peat and one coal—whilst being extended are already being exploited in part, as the plan of their construction provides for running the first set without waiting for the completion of the whole station.

The most powerful of the stations now being built is the hydro-electric station on the Volchoff (200,000 kW). It is to be completed by 1925, taking into account possible delays in materialisation of credits, &c.

The peat-fuel station known as Krassny October (the Utkin factory) was formally inaugurated on October 8th on the completion of its first 10,000-kW set, of which, however,

owing to the backwardness of its cable system, only 4,000 kW could then be used. According to the plan of supply of electricity to Petrograd, this station will serve as a "steam" reserve for the Volchoff station, supplementing the work of the latter when the water level of the Ilmen Lake does not assure its full development.

The peat-fuel station on the Schaturski peat marsh, 120 versts (approximately 80 miles) from Moscow, is still under construction, but the temporary plant of 5,000 kW, which supplies power to Moscow and district, is already running. This temporary station has already done immense service to the electrification system in Russia, as experiments in the adaptation of boilers for the most economic burning of peat fuel have been brilliantly successful. With the new system invented by Prof. Makaryeff, this station set up a world record, raising to 60 (average about 45, against normal 35) kg. of steam per sq. metre surface of boiler, and reducing the consumption of peat to 1.7 kg. per kWh (hitherto 2.5 kg. was considered the normal consumption). According to plan this station should deliver 32,000 kW in 1925 and 48,000 kW in 1927. It will supply electricity not only to Moscow, but to a part of the Moscow industrial district, including Egoryevsk.

The coal-fuel Kaschirski (or Kashira) station is also meant to supply current to Moscow and district,* Kolomna and Serpuchoff. Its first set of 12,000-kW capacity is already serving the Moscow system, but for a few months the cable system can only distribute 5,000 kW. Its second set, of 16,000-kW capacity, is expected to be ready in 1926.

Among the electrification works now being carried out is the extension from 12,500 to 20,000 kW of the electricity supply station that has been running since 1915, and has also been supplying current to Moscow, burning peat from a local marsh. With the fulfilment of the plan for developing the electricity supply of Moscow by the enlarging of this station by 1923 or 1924, and including in the work the new sets of the Schaturski and Kaschirski stations, the stabilisation of the consumption of petroleum will be achieved, notwithstanding the rapid increase in the consumption of electrical current in Moscow, which amounted (in 1922) to 40 per cent. over that of 1921, and exceeds the rate in 1916.

The peat-fuelled station of Nizhegorod, of 20,000-kW power, is being built near the town of Balachni, to be ready in 1925. It will be of great importance in the development of the industry of the Sormovo district. It is proposed to use some of the peat from the marsh, whence it will obtain its fuel, for other industrial purposes, such as the preparation of nitrogenous manures; and besides, there is a project for cheapening electricity by combining its production with that of the manures.

The coal-fuelled Kizelovsk station (6,000 kW) in the Ural will be ready in the present year. It will burn low-quality coal from the local mines, and will supply an important industrial district.

The Schterovsky station, 20,000 kW, to be ready in 1925, will be of great importance to the Donetz basin. It is intended to supply current to the anthracite district, and will burn anthracite smalls (dust), that is not worth carrying any great distance.

Besides the construction of the above-named district stations, and the enlargement of another, studies and projects are proceeding for the construction of a great hydro-electric station on the Dnieper and of a coal-fuelled station at the Chelyabinsk coal mines.

In the meantime work is proceeding in the grouping and connecting of existing stations. Of finished jobs of this kind may be mentioned the coupling up of the small peat-fuelled stations of the Bogorod district, which now send their surplus current to the Moscow system, which enables Moscow, so far as electricity is concerned, to weather any serious fuel crisis with relative ease. There is also the combination of the Tula stations, which has given good results. The operations for the use of the Shirovsky cement factory station are in process of completion for the supply of electricity to the Kolomensk factory and district, as well as the Bolshevsky Manufacturers' Station, for use in the Mytuschtchensky industrial district. The cost of connecting up the Petrograd electrical stations is included in the Budget of the coming year. During last year important work was begun in connecting together the mining stations of the Donetz basin, which will be finished in the present year; the same applies to stations in the Ural, in Sebastopol, and in the central industrial district. Part of the outlay in these cases is borne, however, by local interested concerns, and there are cases in which local interests bear the whole burden.

After the Revolution small-scale electrification developed very rapidly. It was stated in a recent publication that out of 950 power stations of public-utility registered in Russia on January 1st, 1922, 385 were built after the Revolution, and of these 217 were village stations. The total capacity of these stations makes only 2 per cent. of the total capacity of the Russian electricity systems.

The method of the Government bureaux that manage the electrification, with the Government Planning Authority at the head, encourages every sign of initiative in this important division of public economy, directly all the small currents into one great stream, the scope of which is shown in the plan for the electrification of Russia announced and confirmed by the "Eighth Congress."

The Glavelektro has just had its rights extended to a degree of quasi-autonomy. It has been endowed with juridical rights, and can not only dispose of all its financial resources, assigned for estimates for electric supplies and industry, but it has also acquired the right to obtain credit at the Government Bank and at other credit establishments, and from private persons; to give bills on security of movable property; and to take part in "mixed" and other share companies; to deal direct with foreign countries; to organise foreign agencies, &c. According to the new Articles it constitutes a technical control body over the activity of all electrical concerns in the Republic in whatsoever position they may be.

For the constitution of the active control and supervision over the electrical economy of the country, the Glavelektro will form an institute of local electro-technical experts, which will act on the basis of a special constitution. The control of electricity concerns had been divided between the Glavelektro and the Electrostroi (electrical organisations) but divided authority had given rise to considerable inconvenience; thus the Kaschirski station was in the sphere of the Electrostroi, whilst it was exploited for the Moscow system with stations in the sphere of the Glavelektro. The estimates were prepared in sections and then combined, to be reallocated to the respective departments or controls. On the recommendation of a special committee a special series of stations for purely Government purposes will be separated and grouped for Government control alone.

It has been decided to hand over all electrical stations of local importance to the respective local communal authorities, only leaving the management of such stations as are an integral part of the electrical plan of the Republic to the Chief Department of Public Economy. Of such stations, according to the Lesser Soviet Committee, there are thirteen; other authorities think that there are over 30 that should be so transferred, but all are agreed on the principle.

The activity of the Weak Current Trust shows progressive production from month to month. The average production of the third quarter of the past year was 15 per cent. better per month than that of the first half of the year. For example, in September, telephone and telegraph apparatus was delivered by the factories of the Trust to the value of 48,560 gold roubles according to the 1913-14 "catalogue." The improvement belongs to the Petrograd group only; the Moscow group shows a reduction; in fact the production there has fallen to half the monthly average of the first half-year. There has been a considerable increase in the staff of the Petrograd factories of this Trust whilst that of the Moscow factories has declined by from 25 to 40 per cent.

In the Electrotechnical Trust of the Central District are included the electric lamp factories which, for some time, have been increasing their production considerably. These three factories, and a new factory now being built, are in Moscow, and may be considered at the moment the centre of the Russian lamp industry. During the past few years the production of electric lamps in Russia suffered considerably, both in quantity and quality, because of the deficient supply of tungsten and of lead; but now, following on the sufficient supply of these materials, and a radical improvement in the system of production, Russian electric lamps have improved in quality, so that the trust is enabled to sell its lamps at the same price as foreign ones. The rate of production has been raised to 10,000 lamps per day. The production of lamps by the Central District Electric Trust is estimated for the working year 1922-23 at 4,500,000.

For the purpose of increasing and centralising the production, the trust has concentrated the manufacture of lamps in the First Government Factory, formerly the Kudrinsky, and has undertaken the organisation of a new factory, the construction of which is already well advanced, and production will begin there sectionally in the spring. Big results with respect to improvements and rational production were yielded by sending the chief engineer of the factory—Kogan—abroad (to Germany) to see the lamp factories there.

It is interesting to note the profits resulting from the sale of electric lamps. The average factory cost of an "Economic" lamp was 127 roubles in September, and the sale price was 550 roubles.

Great interest has been awakened by the introduction of the production of "half-watt" lamps, at the rate of 50 to 60 lamps per day, in the Moscow lamp factories. The gas-producing apparatus for the completion of these lamps was designed by the specialist engineer, Schauer, who was invited from abroad. This apparatus can provide for a production of 2,000 lamps per day.

Considerable discussion has taken place over the supply of generators for the Volchoff station, which it had been intended to order (eight in all) from abroad, on the ground that such generators as were required for the Volchoff station were not made in Russia. The representatives of the Petrograd electro-technical and engineering works claimed the order and promised punctual delivery. But the engineer Graphtyu, taking his stand on experience, would only agree to the construction of two generators in Russia, the remaining six to be made abroad. A committee having been formed to consider the problem, composed of leading authorities, was

Vide ELECTRICAL REVIEW, December 15th, 1922, p. 898.

divided in its views. The representatives of the Petrograd Electricity Trust claimed that all eight generators should be made in Russia, pointing out that the necessary materials were in the country, in fact they said that the first set could be made entirely from stock. But Prof. Graphtyu was adamant and protested that the Russian shops could not work to time. He proposed a compromise, namely, to give an order abroad for four generators, and an order to Russian works for two generators, the remaining two to be ordered from abroad or in Russia according to the success or failure of the Russian engineers with the order to be entrusted to them. This solution was approved.

Some distance from Yaroslavl, at the Lyapinsk peat marsh, the Lyapinsk district power station is being constructed. It is to be included in the All-Russian system of electrification. Its construction was begun in the early revolutionary period, but in 1922 it was not included in the general plan for the electrification of Russia. Nevertheless, the construction of sections proceeded with local means. But now the electrification of Lyapinsk is provided for in the estimates of the Glavelektro to the extent of 47,500,000 roubles outlay in the year 1923. Still, this sum will cover a very little part of the total required for the completion of the station, for which 1,300,000 gold roubles must be available.

This station is indispensable for Yaroslavl and district. The existing town station is much worn, and suffers frequent interruptions. Yaroslavl is a large manufacturing town with railway workshops and some other large concerns that have their own electrical plants. The Lyapinsk station is regarded as of great importance, and much money for its construction was found. The formation of a special share company was taken up, a Government loan idea having been abandoned. The chances of success are considered to be good, as practically the whole Yaroslavl industrial system lies under the direct menace of deprivation of electricity, for the town station is *in extremis*. The required money (at least most of it) should be available by May 1st next, in which case the station will be built in 1923, and may be inaugurated at the next anniversary of the Revolution.

Amongst the industries that have shown distinct signs of improvement during the last few months electricity takes the leading place, more particularly in the Moscow district, where the pre-war level has been surpassed and far exceeded. Electricity consumption in Moscow experienced a gradual rise, beginning with 1905, without interruption till 1916, when the consumption amounted to 138,000,000 kWh. Then there was a sharp decline without interruption until 1919 down to 57,000,000 kWh, when Moscow "worked in the dark," its industry declined, and its economic life was wasting away.

Only from 1919, with the construction of the Elektroperedatch (electricity transmission) and the equipment of the Schaturski station, a fresh turn took place and an energetic rise followed. In the year 1922, with the starting of the Kaschirski station—the second largest station in the plans for electrification—not only was 1916 surpassed, but the progress continued in 1922, and along with the Bogorod district it amounted to 150,000,000 kWh.

By 1927 it is anticipated that the annual consumption will have risen to 220,000,000 kWh. But Moscow is not Russia. In Petrograd there has been no such progress, in fact the pre-war record has not been reached, nor yet that of the war period, and such has been the case in many towns. Still there are districts where important progress is recorded. The Utkin factory and the Volchoff are places at which important advances in electrical progress have been made. Two of the stations most recently inaugurated, the Pobyedenskaya and the Bobrikovskaya, are of great importance to the whole economic life of the Moscow Basin.

The Pobyedenskaya power station was inaugurated on November 12th last. It is situated in the Skopinsky district or the Ryazan Government. It is built on the bank of the River Verda, two and a half versts from the colony of Pobyedenka, the centre of a coal district. It is equipped with two turbo-generators of 1,500-kW. and 750-kW capacity, and the length of the transmission line is about 10 km. The working of this station means the shutting down of much steam-driven plant in the district, which will be substituted by electric motors. This change will effect an enormous economy in labour, fuel, &c. The application of electricity will make it possible to develop the production of coal in those shafts where the water constituted an impediment.

The Bobrikovskaya station was inaugurated on the same day. It is situated in the Epiphansky district of the Government of Tula. The construction was begun in 1920, but the equipment was delayed by a fire in 1921. It is in the centre of the coal district. The total length of its transmission lines exceeds 6 km. The station is situated adjacent to a shaft, from which the coal is delivered direct to the boiler furnaces. At present there are 2,500 lamps installed in the district hitherto served by a temporary plant. The engineers who conducted the work were S.N. Byelusoff, G. P. Geremino-vitch, and S. S. Michailovsky.

Much has been done in the way of electrification in the Donetz coal-basin, but little compared with what is wanted. In place of the obsolete plant it is proposed by Goerlo to construct five stations in different districts. Keu, on the other hand, proposes twelve district stations. That is to say, whereas Goerlo proposes to electrify the coal districts only, Keu proposes to electrify the iron smelting works as well. The district stations would be connected by a high-pressure system, to which the various gas-driven mining and factory systems would be connected, and these would constitute a supplementary or reserve supply.

In connection with the foregoing we learn from another source that a financial corporation for the encouragement of small local schemes has been organised, with the participation, not only of State institutions, but also of all organisations which stand in close relations with the peasants (agriculturists) and which are interested in rural electrification. The company has as members the Central Co-operative Society (Centrosojus), the local co-operative societies, agricultural associations, &c. One-half of the share capital of 500,000 gold roubles has been subscribed by the co-operative societies, while the other half has been divided between the General Electric Department and the Agricultural Electrical Department. Thanks to the participation of the co-operative societies, the company possesses an organisation for electrical propapanda throughout the country and at the same time the former invests the company with great authority. During the short time since the office creating the company was established an enormous number of inquiries has been received from all parts of Russia from agricultural and workmen's associations, &c., asking for information of the objects and method of working, and desiring to participate in the company.

The company proposes to render assistance to local electrification schemes, both in the purchasing of materials and in the organising of technical matters. In the former case the company has at disposal a capital of 500,000 gold roubles. Official sanction has been received in principle to the issue of a loan for 2,000,000 gold roubles, and a large issue of debentures is also to be made shortly. It will also be necessary to increase the share capital in the near future in view of the continued inquiries being received in mass from those desirous of becoming shareholders. The rural stations do not so much need monetary aid as the granting of credit in the procuring of plant and materials. The organisation of credit in materials opens up for the Russian electrical manufacturing industry an enormous possibility of increasing its sales.

LONDON'S ELECTRICITY SUPPLY: 1920—21.

THE London County Council has published a return for 1920-21 relating to the supply of electricity in the London and Home Counties Electricity District.*

The area dealt with is a wide one, extending from Hertford and St. Albans in the north to Dorking and Reigate in the south, and from Windsor in the west to Gravesend in the East. The authorities with rights to supply electricity in this area are "legion," there being 42 local government bodies and the same number of companies. The division of the district among these authorised distributors is shown very clearly by two coloured maps which accompany the publication. As regards areas, that of the North Metropolitan E. P. S. Co. appears to be the largest, although the County of London E. S. Co. does not lag far behind. The largest municipal supply area is that of Watford U.D.C. The County of London itself is divided between about 30 local authorities and companies.

The total generating capacity of all plant in the area at the end of the year was 518,055 kW, and there was 79,892 kW of transforming plant used by the receivers of bulk supplies. The local authorities owned 220,171 kW of this generating plant, and the companies therefore owned more than half. The number of consumers was in about the same proportion to each class of undertaker. The local-authority load factor was slightly superior, being 22.7 per cent., as compared with the companies' 20 per cent. The highest individual load factor was 34.4 per cent. attained by West Ham; Erith U.D.C. had a load factor of 33.9 per cent.; while the highest figure attained by a company was the 27.4 per cent. of the London E. S. Corporation. The comparative outputs of the two classes were thus not in the same proportion as their generating capacity. The total number of kWh generated or purchased during the year (deducting intersales) was 820,455,018, to which the companies contributed 452,653,383. The sales amounted to 648,342,476 kWh, or 79 per cent. of the output, *i.e.*, companies, 356,150,535 kWh (78 per cent.) and local authorities 312,755,135 (81 per cent.).

The capital invested in electricity supply undertakings amounted to £33,976,372: local authorities £12,359,596 and companies £21,616,776. The average rate of interest paid by local authorities for 1920-21 varied between 3.31 and 5.16 per cent., and that paid by companies (based on incomplete totals) between *nil* and 11.3 per cent., the respective total averages being 3.89 and 5.95 per cent.

The local authorities earned a total revenue of £3,232,047 during the year, and their working expenses amounted to

* No. 2,815. Price, with maps, 5s. Obtainable from the Council or Messrs. P. S. King & Son, Ltd., Westminster.

£2,191,413. Only one undertaking—Epsom U.D.C.—was unable to meet working expenses. A balance of £953,934 remained available to meet capital charges, which amounted to £915,447. Eleven undertakings had to make a call upon the rates, amounting in total to £42,463, to enable them to meet their obligations, and six others drew upon reserves or credit balances. The net total increase in balances, however, amounted to £80,951. At the end of the year balances were as follows:—Renewal reserve, &c., £333,867; sinking funds, £314,387.

The companies' revenue reached a total of £5,092,219, and their working expenses amounted to £3,029,144. The sum of £1,950,312 was available for capital charges, and, so far as could be ascertained, £1,873,327 was expended in this way. Eight companies failed to earn sufficient to meet capital charges. Renewal, reserve, &c., funds showed a balance (incomplete) of £4,485,028 at the end of the year.

A table gives the financial results for the whole period of existence of the 16 Metropolitan Borough undertakings; this shows that a total of £228,664 has been contributed to the rates, while £273,830 has been taken from that source.

Another table sets out the average rates of interest paid by each London company during each year from 1897. From this it is seen that the total average interest in 1920 was the highest yet paid—6.02 per cent., as against 5.76 per cent. in 1919.

Other statistics covering the six years from 1914-15 show that the municipalities expended £8,100,742 on capital account, while the companies spent £17,463,125. It is pointed out, however, that a part of the latter figure represents money paid for goodwill, and, generally, discretion has to be used in comparing company and local-authority statistics.

A complete list is given of the charges made for electricity by the undertakings dealt with, and it is noticeable that the rates of local authorities are generally much lower than those of the companies. The highest rates are charged by the smaller companies operating in semi-rural districts.

It is indicative of the advance of electricity that only in two cases (Stepney and East Ham) was there a decline in the amount of energy sold in 1920-21, as compared with 1919-20. The total increase amounted to 76,432,562 kWh, of which the companies produced 49,006,790 kWh.

The final table contains details of the rateable value of undertakings within the county area, and from this it is seen that the County of London Co. has the highest value—£53,744; the next are the Metropolitan and Westminster Companies with assessments of £45,495 and £43,337 respectively. St. Marylebone has the highest rating among the municipal authorities—£32,350.

The compilation of these statistics represents a great deal of labour, and the publication is indispensable to all who are interested in the important subject with which it deals.

THE WORK OF THE ELECTRICITY COMMISSIONERS.

SECOND ANNUAL REPORT. *(Abstract.)*

(Continued from page 72.)

An application by the managing committee of the South-Eastern & Chatham Railway Companies for consent to establish a new generating station at Angerstein's Wharf, Charlton, was considered, together with an application made by the West Kent Electric Co. for consent to the construction of a new station at Belvedere; a local inquiry was held, and eventually consent was refused.

An application made by the Yorkshire Electric Power Co. had been the subject of an inquiry in May, 1921, and the Commissioners issued their formal consent in November, 1921, to the establishment of a new station at Ferrybridge to contain initially 30,000 kW of generating plant.

The following authorised undertakers were also given consent to establish new generating stations: (*a*) East Grinstead Urban District Council, a station to contain 165 kW of generating plant; and (*b*) Lurgan Urban District Council, a station to contain 200 kW of generating plant.

Altogether the Commissioners issued consents to three authorised undertakers and to nine non-statutory undertakings in respect of new generating stations, such stations representing the initial installation of generating plant having a total rated capacity of about 30,780 kW.

With regard to applications relating to the extension of existing generating stations, the Commissioners during the year under review issued 46 consents to authorised undertakers, three consents to railway and tramway authorities, and one consent to a non-statutory undertaking. The sanctioned extensions represented a plant capacity of approximately 143,700 kW. Of this total, approximately 108,100 kW was in respect of local authority undertakings and approximately 30,500 kW in respect of company undertakings, the railway and tramway generating stations and non-statutory undertaking accounting for 5,050 kW.

Private Generating Stations.

Under the provisions of Section 11 of the Act of 1919 the Commissioners prescribed or approved the type of current, frequency and pressure to be used at new private generating stations proposed to be established by six owners.

The Commissioners have had under consideration the question of the expediency and practical utility of prescribing regulations as to type of current, frequency and pressure in the case of small private generating plants installed for lighting country houses, offices and institutions, and for other private purposes. Having regard to the multiplicity of small automatically-controlled sets installed in country houses and elsewhere for private purposes, to the impracticability of framing general regulations applicable to the widely divergent circumstances under which such plants are installed and utilised, and to the relatively unimportant bearing of the matter upon the question of the public supply of electricity, the Commissioners decided not to make any regulations in the case of small private stations having an installed capacity not exceeding 50 kW, and that it would be unnecessary for those erecting such stations to give any notification thereof to the Commissioners.

The above observations do not apply in the case of small generating stations proposed to be erected by non-statutory undertakings for giving a public supply to consumers for lighting and other purposes. The Commissioners' consent is a necessary preliminary to the establishment of such stations, irrespective of capacity.

Several important applications relating to the establishment of main transmission lines have been under consideration by the Commissioners, and formal consents under Section 11 of the Act of 1919 were issued in the six under-mentioned cases, consideration of other applications being in an advanced stage on March 31st, 1922: (*a*) Cleveland & Durham County Electric Power Co., the establishment of a 20,000-volt line from the generating station of the Tees Power Station Co., Ltd., to a substation of the Cleveland & Durham County Electric Power Co. at West Hartlepool; (*b*) Gorseinon Electric Light Co., Ltd., a 33,000-volt line from the Swansea Borough boundary near Llwyn Cadwgan to the generating station of the company, and thence to Pontardulais; (*c*) Midland Electric Corporation for Power Distribution, Ltd., a 33,000-volt line from the generating station of the company at Ocker Hill to the boundary of the Borough of Wolverhampton; (*d*) Scottish Central Electric Power Co., a 20,000-volt line from the generating station of the company near Bonnybridge, via Grangemouth to Borrowstounness; (*e*) Swansea Corporation, a 33,000-volt line from the Corporation's generating station to Eaton Town sub-station, and thence to the borough boundary near Llwyn Cadwgan; and (*f*) Wolverhampton Corporation, a 33,000-volt line from the Corporation's generating station to the borough boundary.

Certain of the above consents represent the outcome of arrangements for the inter-linking of undertakings. Other applications under consideration at March 31st were of the same character, and there are clear indications of substantial progress being made at an early date in various parts of the country in establishing main transmission lines and interconnecting mains as the first outcome of the schemes that have been formulated for the re-organisation of supply.

Special Orders.

In addition to 26 applications for Special Orders which were still under consideration on April 1st, 1921, the Commissioners received 43 further applications for Special Orders during the year under review.

The general nature of the 69 applications in question is broadly indicated in the following table:—

Nature of application.	Applications made by Local authorities.	Companies.	Persons.	Totals.
Applications by existing undertakers, relating—				
(*a*) to extended or new areas of supply, exclusive of (*b*)	11	18	—	29
(*b*) to the acquisition or transfer of existing undertakings or powers ...	2	—	—	2
(*c*) solely to existing statutory provisions regulating maximum prices	—	8	—	8
(*d*) to miscellaneous matters ...	1	1	—	2
Applications other than by existing undertakers, relating—				
(*a*) to the establishment of new undertakings, exclusive of (*b*) ...	10	6	4	20
(*b*) to the acquisition or transfer of existing undertakings or powers ...	8	—	—	8
Totals	32	33	4	69

A noteworthy feature is the number of applications by local

authorities relating to the acquisition from companies or persons of existing statutory or non-statutory undertakings or of statutory powers not hitherto brought into operation. On the other hand, one application by a local authority provided for the transfer of its undertaking to a company. Many of the applications related to the extension of the areas of supply of existing undertakers, or to the proposed establishment of new undertakings in the whole or a part of two or more local government areas. These applications point to a tendency towards the development of distribution in larger areas and towards the extension of supplies into rural districts.

The number of applications in respect of which the Commissioners granted Special Orders during the year was 38, and the remaining 31 applications were still under consideration on March 31st.

Sanction to Loans.—In addition to the 75 applications from local authorities for sanction to borrowing for electricity purposes which were still under consideration on April 1st, 1921, the Commissioners received 394 further applications during the year under review. Of the 469 applications in question, sanctions either in full or in part were issued by the Commissioners in 389 cases, 5 were refused and 10 were withdrawn or transferred to other departments, leaving 65 applications still under consideration. The total amount sanctioned during the year was £13,650,033, the purposes for which this amount was to be expended being as indicated in the following table:—

Purpose.	Year ending March 31st, 1922 Amount.	Percentage of total.
	£	Per cent.
Land	90,834	0·7
Buildings and civil engineering works	2,137,856	15·7
Plant	6,381,055	46·7
Mains and services	4,098,869	30·0
Meters	208,826	1·5
Other purposes	732,593	5·4
Total	£13,650,033	100·0

Special reference may be made to the sanctions granted to the Manchester Corporation (£2,173,466) in respect of the Barton generating station, main transmission lines, &c.; to the Glasgow Corporation (£1,800,000) in respect of the Dalmarnock generating station; and to the Nottingham Corporation (£1,014,388) in respect of the new generating station to which the consent of the Commissioners was given in 1920. The sanctions granted to those three Corporations and to the Corporation of Edinburgh also accounted for £1,379,014 (65 per cent.) of the total amount sanctioned for buildings and civil engineering works during the year. It may also be noted that two sanctions involving a total sum of £30,000 were granted to enable the Colwyn Bay and Colwyn Urban District Council and the Llandudno Urban District Council to make advances to the North Wales Power Co., Ltd., in respect of works to be carried out in the area of supply of the company with the object of affording supplies of electricity in bulk to the local authorities in question.

Procedure.

Up to the present the Commissioners have not issued special forms of application for use by local authorities desirous of obtaining sanction to borrowing, and it may, therefore, prove of assistance to those concerned to give a broad indication of the procedure to be followed. Applications should, in general, be accompanied by a certified copy of the resolution of the local authority directing the application to be made; by full details of the proposed works and such plans or drawings as may be necessary to the full understanding of the proposals; and by estimates of cost (or tenders where these have been obtained) showing separately the costs of the various items included in the application. In normal circumstances sanction to borrowing should be obtained by a local authority before any liability is incurred for expenditure on works for which a loan sanction is necessary, but there may be exceptions, as in the case of applications relating to ordinary distribution works, such as mains, services, meters and sub-stations on consumers' premises. The Commissioners therefore have adopted the practice of giving sanctions for unspecified prospective expenditure on ordinary distribution works to cover the estimated requirements during a period not exceeding three years, on the understanding that details of the actual expenditure incurred under such sanctions are furnished to the Commissioners in due course.

Loans.

Representations were made to the Commissioners by the British Electrical Development Association on the subject of the maximum repayment periods allowed by the Commissioners in the case of loans for house wiring (10 years) and for domestic and office appliances and apparatus to be let on hire (7 years), the Association suggesting that these maximum periods should be increased, but after a careful investigation of the matter the Commissioners decided to continue their present practice with regard to repayment, but they will be prepared to give further consideration to this question at a later date.

In virtue of their position as loan sanctioning authority for electricity purposes, it fell to the Commissioners to advise the Unemployment Grants Committee on applications made to that Committee by local authorities for grants towards expenditure upon electricity supply schemes and extensions carried out for the relief of unemployment.

The grants originally made by the Committee were based upon a percentage (not exceeding 60 per cent.) of the wages bill for works put in hand for the relief of unemployment, but in September, 1921, the basis was varied to permit a grant up to 50 per cent. of the interest (for a period of five years) on loans for which the repayment period was not less than 10 years.

With regard to applications falling within the original basis of grants, 27 cases were submitted by the Committee to the Commissioners for their observations. In 26 cases the proposed works were approved by the Commissioners, either wholly or in part, as suitable works of public utility, and the Unemployment Grants Committee decided to make grants in 20 of these cases of sums not exceeding £47,185 in total.

With regard to applications to which the modified basis applied, 48 cases in all were submitted by the Committee to the Commissioners for their observations. In 45 cases the proposed works were approved by the Commissioners, either wholly or in part, as suitable works of public utility, and the Unemployment Grants Committee decided to make grants in 44 of these cases. The estimated total capital expenditure on the works for which the grants were promised was £1,979,024, and of this amount £1,530,640 was accounted for by three applications involving the construction of new or the extension of existing generating stations.

Bulk Supply Agreements.

It has been the consistent policy of the Commissioners to encourage and promote the taking of bulk supplies by undertakers where this course has been ascertained to be technically and economically justifiable. There has been marked progress in this direction, and the Commissioners, since the date of the previous Report, have approved of arrangements for mutual assistance in the following six cases:—

The Corporations of Blackburn and Darwen; the Corporation of Hereford and the Leominster Electric Supply Co., Ltd.; the Corporations of Leeds and Morley; the Corporation of Swansea and the Gorseinon Electric Light Co., Ltd.; the Isle of Thanet Electric Tramways and Lighting Co., Ltd., and the Ramsgate & District Electric Supply Co., Ltd.; and the Metropolitan Borough Councils of St. Marylebone and Hampstead.

In the case of two further applications made to the Commissioners, *i.e.*, the Corporation of Wolverhampton and the Urban District Council of Cannock, and the Northampton Electric Light & Power Co., Ltd., the Wellingborough Electric Supply Co., Ltd., and the Rushden & District Electric Supply Co., Ltd., the Commissioners approved of the proposed arrangements and decided to make Special Orders authorising the breaking up of the necessary roads, &c.

Under Section 3 of the London Electric Supply Act, 1908, the Commissioners approved of the Central Electric Supply Co., Ltd., and the Chelsea Electricity Supply Co., Ltd., entering into and carrying into effect an agreement for the supply of electricity in bulk by the former company to the latter. The Commissioners have also approved of the following undertakers entering into and carrying into effect agreements in respect of bulk supplies under private Acts:—The Corporation of Manchester and the Urban District Council of Sale; and the Corporation of Wolverhampton and the Midland Electric Corporation for Power Distribution, Ltd.

Systems of Supply: Regulations.

During the year ending March 31st, 1922, the Commissioners have approved the adoption of standard systems of supply by 23 authorised undertakers, the approvals affecting 27 undertakings. Special reference may be made to the adoption of pressures of 33,000 volts for the transmission of energy in the cases of the bulk supply arrangements between the Corporation of Swansea and the Gorseinon Electric Light Co., Ltd., and by the Corporation of Wolverhampton and the Midland Electric Corporation for Power Distribution, Ltd., respectively.

The Commissioners have given consent to an alteration of the system and pressure of supply hitherto adopted by the Corporation of Kingston-on-Thames.

Other applications were under consideration. It is satisfactory to record that definite progress is being made in the consolidation of the prevalent frequencies in various districts by the gradual elimination of odd frequencies, and also in the wider adoption of three-phase generating plant.

The question of the revision and simplification of the standard codes of regulations was referred to a Regulations Sub-Committee of the Institution of Electrical Engineers, but owing to the numerous technical points requiring investigation and settlement, the Committee has not found it possible to complete its review of the proposed revised code.

The Commissioners are of the opinion that authorised undertakers should, in general, replace their main fuses on consumers' premises without charge to the consumer. In special cases, however, where the consumer has been negligent or has made improper use of the supply, thereby causing the undertakers' main fuses to blow, it is equitable that the consumer should pay for replacement.

(To be concluded.)

THE PHYSICAL SOCIETY OF LONDON.

EXHIBITION OF SCIENTIFIC INSTRUMENTS.

(*Continued from page 50*).

H. Tinsley & Co.

In addition to the apparatus described last week, this firm also showed a new a.c. potentiometer that has been specially designed for the measurement of small phase angles by the potentiometer method. The readings obtained are two e.m.f. components at 90 deg., so that the absolute magnitude of the e.m.f. under measurement must be determined by the square root of the sum of the two squares of the components. The instrument consists of two potentiometers fed with alternating current, in quadrature with each other. In the circuit of the first a reflecting dynamometer of a special design is connected in series which allows of a comparison being made between effective values of the a.c. and d.c. in the following way.—An e.m.f. balance is obtained against a standard cell when direct current is fed to this potentiometer circuit, and the reflecting dynamometer is balanced for these conditions; that is to say, when the potentiometer is recording correct values of voltage. The d.c. is now replaced by a.c. which is adjusted until the dynamometer reads the same value, thus giving correct voltage values in this potentiometer with alternating current, since all coils are non-inductive.

In order to procure perfect quadrature between this "in-phase" potentiometer and the second or "quadrature" potentiometer the following method is employed:—The primary of a mutual inductance is connected in series with the circuit of the "quadrature" potentiometer, and the e.m.f. developed across the secondary of the mutual inductance is balanced against the e.m.f. of the "in-phase" potentiometer. Correct adjustment for phase and accuracy of the "quadrature" potentiometer are made when a perfect balance is obtained. In this way the "quadrature" potentiometer is put in perfect quadrature with the "in-phase" potentiometer. If now the value of mutual inductance is suitably chosen, one volt on the "quadrature" potentiometer can be made to equal one volt on the "in-phase" potentiometer, while this adjustment is being made. In practice it is so arranged that when using 50 cycles the mutual inductance in the circuit of the "quadrature" potentiometer produces a secondary e.m.f. of 0.5 volt, so that by setting the "in-phase" potentiometer at 0.5 volt when adjusting the current of the "quadrature" potentiometer, equality of e.m.f. in both potentiometers is obtained. Similarly, at 60 cycles the potentiometer will be set to 0.6 volt, at 70 cycles to 0.7 volt, and so on. For higher frequencies a value is chosen so that 500 cycles would equal 0.5 volt.

As the range of either potentiometer can be made one-tenth, or if necessary one-hundredth, that of the other potentiometer small phase angles can be multiplied by 10, or 100, and the limit is only reached by the sensitivity obtainable with the vibration galvanometer. The comparison of the "in-phase" and "quadrature" potentiometers is so arranged that the circuits are interconnected, in the desired manner, automatically when the selector switch is turned to "test" position; four independent external circuits can be tested without altering the leads. Thus, for transformer testing, two measurements on the primary and two on the secondary can be made at one setting.

The method of supplying the potentiometer can be either two-phase, with a phase adjusting device in one phase, or two-phase produced from single-phase by means of a phase-splitting device. The reflecting dynamometer which forms a link between the effective values of a.c. and d.c. is independent of temperature and is not calibrated. As it is a zero-reading instrument, when a balance has been obtained on d.c. against the standard cell, the immediate transposition to a.c. will give the same effective value without in any way depending upon the accuracy of calibration of the reflecting instrument, but only upon its constancy for a short period of time between the two adjustments. By using a two-phase source of supply and keeping the total impedance of each potentiometer circuit equal, the potentiometer becomes very largely independent of frequency fluctuations, especially if the resistance is made to swamp the inductance of the circuit.

The accessories include the fixed mutual inductance for inter-comparison with which more than one frequency range can be provided, and the reflecting dynamometer that is constructed throughout with the absolute minimum of conducting material, and all metal parts are of high-resistance alloy to reduce eddy currents. The swinging coil is connected in series with two field-coil sections and forms an astatically-wound system suspended upon a small mica vein. Oil damping is provided and the sensitivity is such that a few parts in 10,000 in current changes can be detected without difficulty. A torsion head is provided for balancing the torque of the instrument and a tangent screw is added for very fine adjustment of the balance.

FIG. 6.—"METROHM" BRIDGE.

Everett, Edgcumbe & Co., Ltd.

MESSRS. EVERETT, EDGCUMBE & CO., LTD., made a feature of instruments illuminated internally, having open glass fronts, so as to show the working parts. The e.h.p. electrostatic voltmeter for 60,000 volts, which we described last year, is now made for all voltages up to 300,000, and being air insulated, is entirely free from frequency and wave-form errors, so that it can be used up to the highest frequencies.

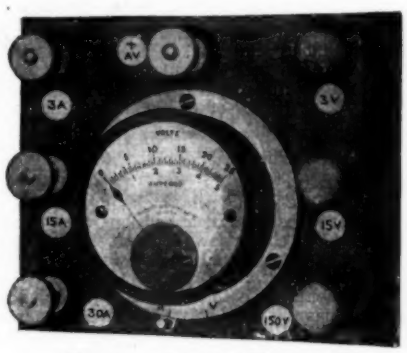


FIG. 5.—"DWARF" TESTING SET.

A particularly compact testing set may be mentioned, which performs the function of an a.c. ammeter, voltmeter, and wattmeter by means of two instruments only. The convenience of such a set will be obvious; if only amperes and volts are to be measured an even more compact combination is available, whereby both amperes and voltage are measured on a single instrument of half the size. Both these sets are suitable for single or polyphase measurements, whether the loads are balanced or unbalanced. For use with them, as well as for general a.c. testing work, Messrs. Everett-Edgcumbe have developed the "Omni range" current transformer, so called from the fact that as distinguished from the usual "Multi range" transformers the ranges are almost unlimited in number. One "Omni range" transformer has a minimum of eight ranges—*viz.*, 6, 24, 120, 240, 400, 600, 1,200 and 2,400 amps. The first three ranges are obtained by means of self-contained primary windings, and the remaining five by threading a cable a suitable number of times

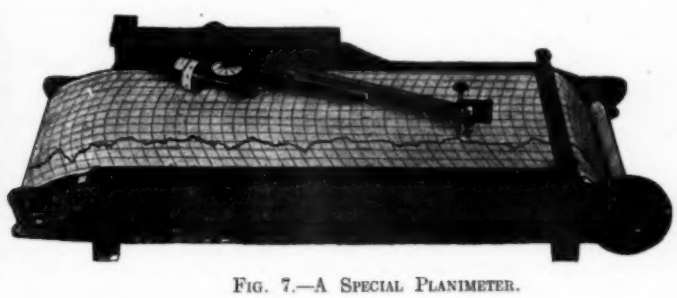


FIG. 7.—A SPECIAL PLANIMETER.

through the centre opening. By this device, not only can the ranges be indefinitely increased, with the assurance of equal accuracy on all of them, but the size of the transformer is reduced to a minimum.

At the other end of the scale amongst the test sets comes the extremely compact and popular "Dwarf" testing set, illustrated in fig. 5 (without its leather carrying case) which is particularly useful in connection with radio receiving sets. The instrument has the following ranges: 3, 15 and 150 volts for testing the high- and low-pressure batteries, 1, 5, 3 and 15 amps. for measuring the valve current, and 15 milliamps. for measuring the anode current. It is thus particularly suited to the requirements of the experimenter, and in a plush-lined leather case, with snap fastening, measures overall only 5½ in. x 4¾ in. x 2¾ in.

Fig. 6 illustrates the recently-developed Everett-Edgcumbe "Metrohm" bridge, which comprises the well-known constant-voltage "Metrohm" for 100 megohms at 500 volts, together with a four-dial direct-reading Wheatstone bridge, by means of which resistance measurements can be readily made from the lowest values up to one megohm. It thus fills the gap which is left below the useful range of the "Metrohm" itself. For bridge measurements the "Metrohm" serves as an extremely sensitive galvanometer. A useful variation which is available consists of a galvanometer and battery self-contained in the bridge itself, by means of which the latter can be employed independently of the "Metrohm," which may at the time be in use elsewhere.

Fig. 7 illustrates a special form of planimeter developed for the determination by a single measurement of either the average value or the total value of the quantity recorded on a grapher chart. It is only necessary to traverse the chart under the planimeter pointer, which is conveniently done by passing it from one to the other of two rollers provided for the purpose, and the integrated value can be read off at a glance. Previously it was necessary to divide the record up into a number of comparatively small portions, the area of each of which had to be separately determined; the areas were then added together and their sum had to be divided by the length of the chart, a most laborious process, which is entirely obviated by the use of the present instrument. This planimeter has proved particularly valuable for use with graphic power-factor meters, in connection with power-factor correction, or with systems of payment based upon the consumers' power factor.

Evershed & Vignoles, Ltd.

MESSRS. EVERSHED & VIGNOLES, LTD., had on view "Megger" and bridge-testing sets, including the new "Meg" tester that was recently described in our pages; also "Ductor" potential ohmmeter low-resistance testing sets, workshop ohmmeters, a dionic water tester, portable and switchboard-indicating instruments. Finding that clocks for recording instruments have to be specially designed for their work, the firm has installed plant for the manufacture of clock parts, and has taken advantage of the changes necessitated by the adoption of this policy to re-design the Murday recording instrument entirely; its construction has been simplified, all parts being made more accessible, while weight and size have been reduced. The amount of the visible record has been increased, while the printing machinery produces charts of the clearest and most readable character. It will be remembered that the chief feature of the Murday system is the rectangular co-ordinates of the chart which result from the particular form of pen and pivoting employed. The present design follows the same general principles, but the improved construction permits of the use of various forms of pen, including the reservoir type.

The case, of the switchboard pattern, is damp- and dust-proof, yet very easily opened and closed, while the portable instrument does not have to be levelled, the pen always resting on the paper in the same position and with the same pressure, thus reducing errors to a minimum. The instruments, whether ammeters, voltmeters, wattmeters, leakage recorders, or other types of recording instruments, are made with three kinds of clock movement, either the continuous-roll chart, which is most suitable for general work where the chart can be torn off daily or left to run for a considerable period without attention, and a wide range of speed can be obtained from a fraction of an inch per minute to several feet per second, or the drum- and disk-type instruments, in which the clock makes one revolution per day or portion of a day as desired. Instruments of the duplex or feeder log chart types, having two movements in one case, can either be an ammeter and voltmeter, voltmeter and wattmeter, or any combination desired. Fig. 8 shows the pen and chart-moving mechanism of the log recorder, the shield covering of the "movements" being shown in phantom so as to make the details visible. It is often not difficult to secure, in addition to two quantity records, one or more records of another character, and the firm has even succeeded in combining three quantity records with "a moment of operation" record in a special case.

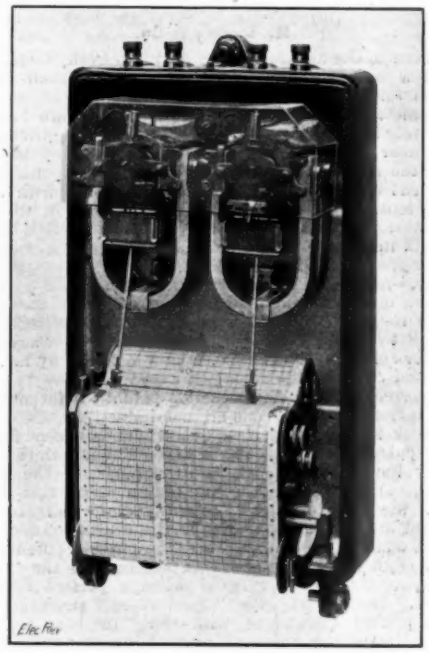


FIG. 8.—LOG RECORDING INSTRUMENT.

(To be continued.)

THE PACIFIC CABLE BOARD.

ANNUAL REPORT.

THE annual report of the Pacific Cable Board for the financial year April 1st, 1921, to March 31st, 1922, reveals the fact that the receipts for the year exceeded the ordinary expenses by £210,257, from which excess a special contribution of £100,000 has been made to the reserve and renewal fund for cable duplication purposes, in addition to the normal annual payment to the fund of £30,000 and £2,800 earned by the c.s. *Iris* on repair services for other administrations, making a total contribution to the fund of £132,800.

After payment of the above special contribution, and also of the annuity of £77,545 to the National Debt Commissioners in respect of interest and repayment of the capital of £2,000,000 advanced for the Pacific cable, and of the annuity of £9,150 to the renewal fund for interest and sinking fund on £177,254 borrowed from that fund for the Auckland-Sydney cable, there remains a surplus of £20,762, which will be applied, in accordance with the Pacific Cable Act, 1901, in reduction of the outstanding balance of the original advance of £2,000,000.

Notwithstanding a substantial increase in the volume of international traffic, the traffic receipts (£521,643) fell short by £98,409 of those of 1920/1921, being the result largely of the reinstatement of cheap services (notably week-end telegrams) which have, in part, taken the place of traffic at the higher rates, and have created a considerable volume of new traffic. This has not sufficed to maintain the revenue at its previous standard, but the Board regards the situation as highly gratifying. The total assets of the reserve and renewal fund on March 31st, 1922, amounted to £1,777,492.

Interruptions on the Board's cable system occurred on three occasions during the year, the interrupted cable being in two cases that between Norfolk Island and Auckland in April and October, 1921. Both breaks were caused by corrosion. The frequency of interruptions in the neighbourhood of Norfolk Island (where three cables land) is disquieting. The conditions in this locality are singularly unfavourable to the life of cables. Fortunately, the recent interruptions have all been on the Auckland cable, and have only caused minor dislocation of facilities. When new cables are laid between Suva and Auckland direct, and between Southport and Sydney, the conditions at Norfolk Island will no longer give ground for anxiety.

The other interruption was at Fanning Island. When the shore ends were destroyed in September, 1914, by the German

cruiser *Nurnberg*, the only type of cable which was available for the laying of new ends was of a light pattern which would ordinarily not be used for such a purpose. Accordingly the *Iris* was sent to Fanning Island in May, 1921, to lay new shore ends with appropriate type of cable. Twin-core cable was used for the new ends, and the result has been to reduce the electrical disturbance due to the proximity of the cables to one another and permit a slightly higher speed of reception at Fanning Island.

The depôts, instruments and plant generally have been maintained in a high state of efficiency.

The new system of working at Auckland with Cox magnifiers and interpolators and Creed printers was brought into effect during the year under review. The installation has fulfilled all expectations, and has made it possible to effect large reductions in the staff at Auckland. Traffic now passes between Australia and Fiji without retransmission, being automatically relayed at Auckland.

At the invitation of the board Mr. H. Tinsley, of Messrs. H. Tinsley & Co., of London, proceeded to Auckland in January, 1922, and conducted certain experiments on the board's cables which, it is hoped, will enable him to devise methods of reducing or eliminating impedance, thereby increasing the speed of working. A report on the result of the experiments has not yet reached the Board from New Zealand.

Proposals for duplicating the Pacific cable were submitted to the partner governments, but the Board has been led by certain cogent circumstances (notably by a new but untried type of cable) to defer, for a short time, the provision of additional channels of communication for the long stretches between Canada and Fiji. These considerations do not affect the southern sections, and the Board is accordingly making further representations to the partner governments with a view to laying a direct cable between Suva and Auckland, and one between Southport and Sydney. (It was announced recently that the contracts for these cables had been placed in this country.)

The landlines in Canada leased by the Board from the Canadian Pacific Railway suffered few interruptions, and worked well throughout the year.

The introduction of the new system of fast speed Wheatstone working with Creed apparatus between Sydney and Melbourne was delayed owing to the withdrawal by the Commonwealth Post and Telegraph Department of the special direct telegraph line which, since July, 1915, had been allocated for the exclusive use of the Board's traffic. The original wire was returned to the Board in February, 1922, and Wheatstone working is now successfully employed between Sydney and Melbourne at a speed of 100 words per minute.

The Board's auxiliary schooner *Tangaroa* was maintained in satisfactory condition, and the cable maintenance vessel *Iris* continues in first-class order. In addition to the repair operations mentioned above, the *Iris* carried out the following repairs: New Zealand Post and Telegraph Department's Wanganui-Wakapuaka cable, December, 1921; Eastern Extension Telegraph Co.'s Sydney-Wellington No. 1 cable, January, 1922.

During the year nearly 8½ million paying words of international traffic (*i.e.*, other than local traffic between Australia, New Zealand, and the Pacific Islands) were transmitted across the Board's system—approximately 600,000 words in excess of the total during the previous year. In addition approximately 2,300,000 paying words were carried between Australia and New Zealand and between those Dominions and the Pacific Islands—approximately 200,000 words less than during the previous year. The ordinary, or full-rate international traffic, showed a decrease of approximately 1,160,000 words, and the Government traffic a decrease of approximately 350,000 words; there was an increase in deferred ordinary traffic of approximately 100,000 words, and in week-end messages of over 2,000,000 words. The week-end telegram service was, however, not reinstated until the latter part of the financial year 1920-1921.

While the reduction in the ordinary traffic was mainly due to greater use of the cheaper services, it was partly accounted for by the fact that the Eastern Co.'s route did not suffer occasional curtailment of facilities to the same extent as during several previous years; accordingly the amount of ordinary traffic received owing to diversion was far less. The decrease of the traffic between Australia and New Zealand does not indicate any competitive set back, but was due solely to the trade depression. The growth of the week-end traffic has been rapid, and has now reached the limit of the cable's capacity. If there is any further increase the Board must curtail the service until the facilities are augmented by the duplication of cables. This they would be very reluctant to do, but there would be no other possible course.

The Imperial cable (the ex-German cable across the Atlantic administered by the British Post Office) was interrupted from August 14th to 28th, 1921, and from October 27th, 1921, to January 7th, 1922.

Since the close of the year the Post Office has taken over the second Imperial Atlantic cable which was purchased by the Government from the Direct United States Cable Co., and had been leased by the department to the Western Union cable system. The working of the Canadian end (at Halifax) is undertaken by the Board for the department under similar conditions as apply to the working of the other Imperial cable.

THE CASE FOR ELECTRICITY.

THE E.D.A. Salesmanship Conferences were resumed on January 5th, when Mr. J. W. Beauchamp, the director of the Association, gave a lecture which bore the title "Notes on Competition between Electricity and Other Forms of Light, Heat and Power."

CAPT. R. S. HILTON (Metropolitan-Vickers Electrical Co., Ltd.), who presided, said he regarded the work of the Electrical Development Association as only just beginning and looked forward to the existence of a much more powerful and richer body than that which they now had. Larger subscriptions ought to be made to the Association by electrical undertakings, manufacturers and others, but perhaps it was that everybody was a little cautious and anxious first to see the E.D.A. justify itself, and then much greater financial support would be forthcoming.

MR. BEAUCHAMP said that it had occurred to him that it would be worth while to devote an evening to discussing how a salesman should reply when challenged by competitors or by prospective customers armed with arguments obtained from sellers of gas or fuel. In selling electricity, it should be kept in mind that electricity was required to perform some task which had hitherto been done by a different and grosser medium and that an entirely new method was being introduced, not merely a substitute for an already existing one. Working on these lines, Mr. Beauchamp dealt with his subject under the various headings of light, power, and industrial and domestic heating and cooking. In the majority of the applications of electricity price was the least important factor from the point of view of dealing with competition; the competition really lay in the advantages offered by electricity quite incidental to and independent of price. For instance, the secret and whole foundation of the work of the illuminating engineer was that with electricity the light was concentrated to a degree which had never been obtained before, apart from the adaptability of electric lighting, relative coolness and so on. On the question of price, however, it could be demonstrated that with gas at 5s. per thousand cubic feet and electricity at 7d. or 8d. per unit, there was, if anything, a balance in favour of electricity.

Similarly, with electric power, there was a chain of arguments which had little to do with cost. At first a convenient method of driving machinery, it was quickly recognised as offering wonderful possibilities for the exact measurement of power, and that fact alone had a remarkable influence on the study of cutting speeds, tool angles, &c. Electric power had also made possible close investigation with regard to different methods of cutting and working metals, and in many cases there was no other form of power possible. In the case of small power, such, for instance, as the dentist using a ¼-h.p. motor for a task which returned him a guinea or two, the cost of the power was of little or no importance, and in the same way the actual price per kWh hardly entered into the balance sheet in many factories. The incidental advantages were so enormous that electric power was the most advantageous whether the price were 1d. or 8d. per unit. In the majority of cases the cost of power in a factory was only from 2 to 5 per cent. of the total outgoings. This argument applied in varying degree right up to the large winding engine in a colliery, or rolling mills. In the case of users of moderate quantities of power, as distinct from the small user, the competition would probably be with a small steam engine, housed in a building in the yard, and here the task was an easy one, because it could easily be demonstrated that this plant could be put out of use and electric power substituted, with a consequent saving in all directions. In addition to all this, the sheds previously used to house the engine could be put to profitable use by installing productive plant. They would also encounter, of course, gas engines, and Diesel engines, but a careful study of competition points came in handy and even though the gas interests said that electricity cost 3 to 5 times as much as gas, the electrical salesman need not feel discouraged, for the manufacturer could be shown there were many advantages in electricity, such as not having the responsibility for running the plant.

Passing to heating, Mr. Beauchamp dealt first with industrial heating and referred to its advantages in metal working, hardening and tempering tools, and so on, and pointed out that in 80 per cent. of cases the incidental advantages were so great that thermal efficiency was not the deciding factor.

As regarded electric heating in the home, the need there was for the industry to keep closer to the consumer, to give more and better advice, and, as far as possible, prevent him from buying appliances which would not give satisfaction either at the rates current in the district or owing to the manner in which the appliances were used. The salesman must give good advice as to how and when a consumer should be advised to use a radiant or convective type of heater. There was a large business to be done with the heater for occasional purposes, such as bedrooms, &c., if the consumer was told how he could get additional comfort for a few pence per day, but these appliances must not be put forward as useful for long-hour work. It was of little use talking to a customer, to whom they were trying to sell a radiant heater for a bedroom, about the cost per unit. A much better result was likely to be obtained by speaking of the cost per day or per week, because it was not necessary to sell electricity for any purpose at the price of its competitors. It was necessary to have information at disposal as to the consumption of various pieces of gas apparatus; otherwise, if the consumer was told only the cost of electrical appliances, he might think it was a lot of money. Then there were the disadvantages of the competing appliances, such, for instance, that no gas apparatus should be used in any small room without a flue, as admitted at the British Commercial Gas Association Conference this year.

Dealing with electric cookery, Mr. Beauchamp said that the main point was to make it clear that by the use of electricity the whole practice of kitchen management was being changed. Unlike gas, there was no question of any adulteration. He concluded by saying that the principal thing, after all, which should be sold was confidence. That could only by obtained by seeing that the consumer had reliable apparatus and used it under the proper conditions. Electrical people should use electrical appliances up to their full limit and then go out and get their immediate neighbours to do the same.

In the discussion which followed, Mr. R. S. DOWNE (Brompton & Kensington Co.) said that one of the most difficult parts of the business of selling was that the consumers did not know so much about electricity and its uses as the salesmen often imagined, and they had to be taught. In the domestic field very little had been done in the way of services other than lighting.

MR. F. A. GILLOTT speaking of the incidental advantages of electricity, mentioned a co-operative society which stored some 300 hams by hanging them in a store which was lighted by gas; between the time the hams came in and the time when they were sold, there was a loss of about ¼ lb. or ¾ lb. per ham, owing to the heat from the gas lamps. This was remedied by electricity.

MR. L. L. ROBINSON (Hackney), regarded the paper as the best he had listened to on this subject, and suggested that it should be printed in pamphlet form and distributed to the members, because it would be most useful to bring before electricity committees. As to the advantages of electricity for lighting and cooking, a short time ago a small housing estate of 80 houses was put up in his district and the cost of installation was £22 for electricity against £6 quoted by the gas company, of course at a loss. As a result, he was not allowed to wire the houses in question. A little later, another estate of 63 maisonettes was erected, the rents of which were 7s. 9d. per week. In each of these he had put a cooker and six lights, both on the prepayment system, the charge being 8d. per unit for lighting, of which 2d. was for hire of installation; and 1½d. per unit for cooking, of which ½d. was for hire of the cooker. The tenants of this estate had told him that they were putting less into the prepayment meters than they did in their old houses when they had gas, and now the tenants on the first estate had complained because they had not electricity. The result was that the Council was going to spend £1,000 to wire the first estate. This showed that first cost was not everything.

MR. P. F. CRINKS complained of a want of loyalty on the part of some borough engineers—(not borough *electrical* engineers)—who sometimes suggested, in connection with housing schemes, that gas cookers were cheaper. That was done because the local electricity supply authority was perhaps not in the position to take on a big cooking load, but it was a bad policy.

MR. A. G. WHYTE (*Electrical Industries*) asked whether it was better in the case of people already using electricity for lighting, to "push" the use of small apparatus and go gradually up to the big cooker, or to advocate the big cooker first.

MR. L. L. ROBINSON said his experience had been that it was best to go right out at first for the big cooker.

MR. E. T. RUTHVEN-MURRAY (North Metropolitan E. P. S. Co.) spoke of the importance of winning the confidence of the customer by discussing the advantages and characteristics of electricity and electrical apparatus, and pointed to a danger of not winning that confidence if they proceeded on the lines of always belittling gas.

MR. E. SHARP pointed out that a great deal still remained to be done in the field of lighting, particularly street and shop lighting. As to domestic heating, the immersion water heater was a useful appliance.

MR. BEAUCHAMP, replying to the discussion, said that one difficulty at the present time was that undertakings which were not in the position to take on a big cooking and heating load, quoted very high prices, and did harm by creating the impression that electricity for these purposes was dear. They should be frank with the public and explain the reasons why big cookers could not be accepted for the moment. He agreed that the policy of slanging one's opponent was no policy at all, and it certainly was not the policy of the E.D.A., to do that as propaganda. In what he had said with regard to gas, he had merely been speaking to them intimately on some of the points that actually arose in selling in competition with gas.

ELECTRICALLY-HEATED HIGH-PRESSURE STEAM BOILERS.

WE here reproduce a photograph (fig. 1) of the electric boiler installed on the North-Eastern Railway passenger locomotive, and described in the paper that Sir Vincent L. Raven, K.B.E., recently read before the Institution of Mechanical Engineers.

The boiler is of 408 kilowatts capacity, which is sufficient to heat the largest train dealt with in ordinary service. The Bastian Quartzalite heating elements are of special design for connection across the full line pressure of 1,500 volts, and

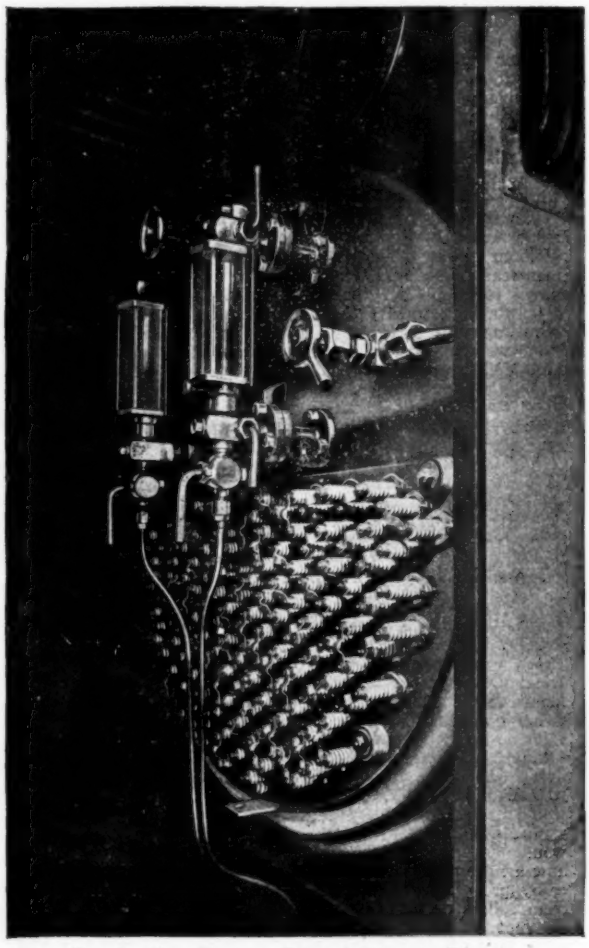


FIG. 1.—END VIEW OF BASTIAN ELECTRIC BOILER.

boiler trials have yielded an efficiency of 98 per cent. During one trial at about three-quarter load, with an input of only 298 kWh, 970 lb. of water was evaporated at 120 lb. pressure, and this pressure was reached in 24 minutes from first switching on, with feed-water at 41 deg. Fahrenheit.

This multitubular-type boiler is fitted with 144 tubes, each of which contains a Bastian Quartzalite heating element of 2.84 kW capacity. The Tabasco resistances inside ¾-in. Quartzalite tubes are of Messrs. Bastian & Allen's patented closely-wound spiral construction, which excludes the possibility of "hot spots" developing through irregularity in the spacing of the convolutions. The possibility of such "hot spots" had to be rigorously guarded against in the case of this 1,500-volt boiler, as they would have tended to overheat the quartz, and thereby break down the insulation of the quartz

tubes, whereas by properly controlling the temperature of the spiral, Messrs. Bastian & Allen claim that the high insulating properties of quartz can be utilised to full advantage, and that they are able to design and supply boilers fitted with their Quartzalite heating elements for use on d.c. lines, even up to 3,000 volts.

Taking the surface of the 144 Tabasco spirals as being equivalent to the grate surface of a fuel-fired boiler, the surface ratio of the Bastian & Allen boiler is only 2; and although the boiler is of approximately 547 h.p., it is only 3 ft. 4 in. in diameter by 3 ft. 4 in. long over the tube plates. The shell is ⅜ in. thick, and is riveted to the flanged tube plates (which are ½ in. thick) by a single row of ¾ in. rivets. The wood lagging is ¾ in. thick, and the boiler is finally clothed with 15 B.W.G. mild steel plates.

The illustration shows the front end of the boiler with the cover-plate removed, and the heating elements, which pass through the boiler tubes from end to end, are supported between buffer springs, and are thus well protected against damage through the violent vibration and mechanical shocks inevitable on such service. Extended trials with a small 50-h.p. boiler proved that all the requirements were satisfactorily fulfilled. It should be a comparatively simple problem to design such boilers for stationary use in situations where steam may be required for some industrial purpose, and where it cannot conveniently be produced near at hand by means of a fuel-fired boiler. The saving in labour, the elimination of heat losses from long lengths of steam pipe, and the elimination of flue losses, are all to be taken into account when considering whether the electrically-heated boiler is a practical proposition from the running-cost point of view. There is no doubt about the "convenience" aspect.

In the boiler under notice ample heat regulation is provided, as the elements are connected in four groups, by means of which heating capacities from 68 kW up to full load can be obtained in six steps of 68 kW each, and the boiler is automatically protected against damage through short circuit, or burning out and consequent arcing of the heating elements, by four electromagnetically balanced relays.

Thanks are due to Sir Vincent L. Raven for information regarding this interesting boiler, which was designed by Mr. C. Orme Bastian in consultation with Messrs. Merz and McLellan. It is obviously preferable to dispense with the oil-fuel boilers, which are used for train heating in other countries on electric locomotives, and, of course, steam for heating must be available on lines where the system of traction is changed from electric to steam, or *vice versa*, over different sections.

AN ELECTRO-CHEMICAL PHASE ADVANCER.

Satisfactory Operation at Sheffield.

In the course of an animated discussion that took place at the well-attended meeting of the North Midland Centre of the Institution of Electrical Engineers at Leeds on November 21st, 1922, when the late Dr. G. Kapp's paper (which was abstracted in our issue of November 24th, 1922) on the "Improvement of Power Factor," was read and discussed, Dr. T. F. Wall, A.M.I.E.E., described an electrochemical phase advancer that is in daily operation on a shop motor

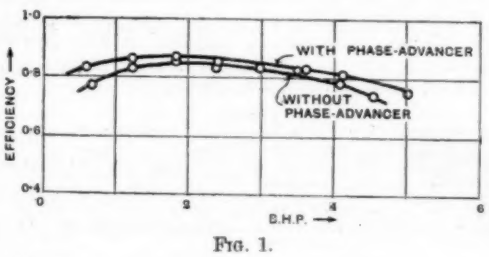


FIG. 1.

circuit in a large Sheffield establishment, and which we understand is functioning very successfully.

DR. WALL pointed out that he had recently been engaged in studying a new device for phase-advancing with induction motors, in which the electrical energy was stored during one part of the cycle in the form of chemical energy, and during the remainder of the cycle was released in the form of electrical energy. The principle was thus the same as that of a secondary battery, such a battery being, in effect, an electrical condenser of very large capacity.

Two lead grids, A and B, were pasted with red lead (Pb_3O_4), immersed in dilute sulphuric acid, and connected in circuit with an alternating-current supply. Then, during one half-cycle the paste of one grid—say A—became oxidised to the higher oxide, and the paste on the other grid became reduced to the lower oxide. In other words, the arrangement corresponded to an accumulator on charge, the grid A being the positive plate. During the next half-cycle the action was reversed, the cell became discharged and recharged in the opposite direction.

It was found that the action was greatly assisted and improved if the cell worked at a relatively high temperature, say, about 80 deg. C. When the temperature was so increased the gassing became negligibly small and the inherent power-factor became very low—that was to say, the losses were low and the phase advance of the current on the p.d. was large.

In fig. 1 that effect was clearly shown. The readings were taken by connecting a cell to a low-frequency supply and immersing the cell in a bath the temperature of which could be regulated. It was clear that a very considerable improvement of the action of the cell took place up to about 70 deg. C, and subsequently the improvement was less marked with

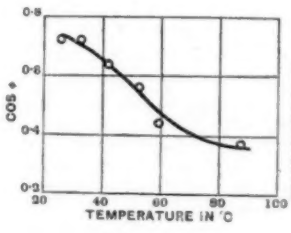


FIG. 2.

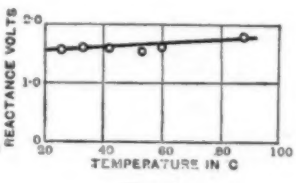


FIG. 3.

increase of temperature. In fig. 2 the corresponding values of reactance voltage were plotted as a function of the temperature.

The effect of increasing the temperature appeared to be two-fold, *viz.*:—(i) The specific resistance of the electrolyte was reduced; and (ii) the chemical activity of the components of the cell was stimulated. With regard to the second effect it was of interest to note that the action of a certain lightning arrester was based on the fact that the chemical stability of lead oxides was very easily upset by relatively small temperature rises.

Dry lead peroxide (PbO_2) had a specific resistance of about 1 ohm per inch cube, the resistance varying with the pressure with which it was compressed. At a temperature of about 150 deg. C. lead peroxide was reduced to red lead (Pb_3O_4), which had a specific resistance of about 24 x 10^6 ohms per inch cube. At slightly higher temperatures red lead was reduced to litharge (PbO), which was practically an insulator.*

In figs. 3 and 4 the results of some tests on a 4-b.h.p. induction motor were given. These tests were made by two post-graduate students, Messrs. G. Allson, M.Eng., and C. E. Robinson, M.Eng. The data were obtained with two cells in series per rotor phase, and clearly showed the beneficial

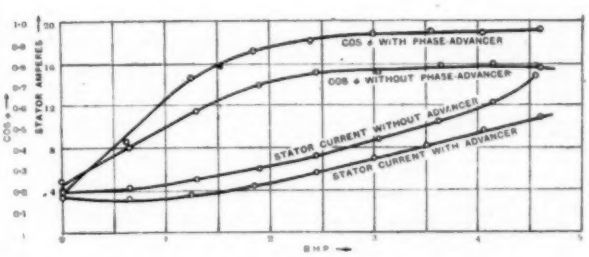


FIG. 4.

effects to be obtained by the use of that type of phase-advancer. These curves showed the remarkable and important result that the efficiency of the motor was actually greater when the phase-advancer was inserted in the rotor circuit than when the motor was running under the normal condition of short-circuited slip rings.

A Shaft Signal Recorder Wanted.—The *South African Engineering and Mining Journal* states that the Rand Mutual Assurance Co., of Johannesburg, is offering prizes not exceeding £250 for the most practical device for recording shaft signals, &c., in the mines. Among the conditions covering the competition, it is provided that the apparatus must be capable of being applied to existing plant; estimates of cost are required; and the apparatus must record all signals given and received by the driver to and from all positions, and register the time during which the conveyance is in motion. The competition closes on September 30th.

*See *General Electric Review*, September, 1918.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Patent Agents, 285, High Holborn, London, W.C. 1.

4. "Electrical cases." R. W. Bill and H. Heath. January 1st.
12. "Electric resistances." M. McClelland. January 1st.
26. "Loud-speaking devcies for telephones." S. M. Rowlands. January 1st.
40. "Electric arc welding." W. Langdon-Davies and A. Soames. January 1st.
46. "Wireless navigational apparatus." T. H. Gill and N. Cox-Walker. January 1st.
47. "Devices for indicating magnetic directions." N. Cox-Walker. January 1st.
89. "Shield for radiography, &c." R. E. C. Akerlund. January 1st. (Sweden, December 30th, 1921.)
94. "Centrifugal mechanism for electric switches, &c." British Thomson-Houston Co., Ltd. January 1st. (United States, June 8th, 1922.)
95. "Vehicle lamps." British Thomson-Houston Co., Ltd. January 1st.
97. "Electrically-driven vehicles." J. B. Parker. January 1st.
103. "Locking device for securing electric lamps to holders." C. W. Saunders and S. D. White. January 1st.
107. "Sparking plugs." Sir R. A. S. Paget and Thermal Syndicate, Ltd. January 1st.
112. "Aerial for wireless apparatus." J. H. Cook. January 1st.
116. "Electric or mechanical advertising devices." P. Gate. January 2nd.
129. "Telephone recorder." A. G. Adams and M. B. Brailsford. January 2nd.
133. "Manufacture of electric cigar, &c., lighters." T. Rondelli. January 2nd.
134. "Amplifying systems for wireless telegraphy, &c." Radio Communication Co., Ltd., and J. Scott-Taggart. January 2nd.
135. "Coupling electric circuits for wireless telegraphy, &c." Radio Communication Co., Ltd., and J. Scott-Taggart. January 2nd.
136. "Insulators." Radio Communication Co., Ltd. January 2nd.
143. "Means for recording separately local and trunk telephone calls." F. H. Page. January 2nd.
148. "Electric power-transmission systems for vehicles." J. B. Entz. January 2nd. (United States, November 5th, 1920.)
150. "Loud-speaking telephones." S. M. Franses. January 2nd. (France, November 21st, 1922.)
152. "Grid leaks for thermionic valves." Bindin & Brooke, J. R. Bindin, and T. E. Brooke. January 2nd.
154. "Manufacture of electric resistances." H. B. Clapp. January 2nd.
159. "Power generating plants." British Thomson-Houston Co., Ltd. (General Electric Co.). January 2nd.
160. "Control systems for electric furnaces." British Thomson-Houston Co., Ltd. (General Electric Co.). January 2nd.
161. "Electric circuit-breaker systems." British Thomson-Houston Co., Ltd. (General Electric Co.). January 2nd.
162. "Private branch exchanges." Western Electric Co., Ltd. (G. Deakin). January 2nd.
173. "Dry-battery machines." L. A. Freedman. January 2nd.
184. "Jointing metal-sheathed electric cables." P. Dunsheath and W. T. Henley's Telegraph Works Co., Ltd. January 2nd.
188. "Means for testing electric meters, &c." G. E. Moore. January 3rd.
195. "Commutators or contact-breakers for electrical ignition systems." F. W. Baker. January 3rd.
201. "Means for starting engines of automobiles." Sir H. Austin. January 3rd.
221. "Rectifiers for electric circuits." C. H. White. January 3rd.
230. "Electric striking apparatus for clocks." G. Bühler. January 3rd. (Germany, May 20th, 1922.)
233. "Electrical installation for remote control of indicating instruments." Favarger et Cie. Soc. Anon. January 3rd. (Switzerland, January 19th, 1922.)
239. "Illuminated signs, &c." S. N. Wolf. January 3rd.
241. "Under-frames for tramway vehicles." Brush Electrical Engineering Co., Ltd., and W. E. Hall. January 3rd.
248. "Modulators." British Thomson-Houston Co., Ltd. January 3rd. (United States, January 12th, 1922.)
249. "Integrating and registering mechanism for flow-meters, &c." British Thomson-Houston Co., Ltd. (General Electric Co.). January 3rd.
250. "Electro-magnets." British Thomson-Houston Co., Ltd. (General Electric Co.). January 3rd.
274. "High-frequency electric signalling systems." Radio Communication Co., Ltd., E. H. Robinson, and J. Scott-Taggart. January 4th.
281. "Telegraph poles, &c." J. Cubbin, J. Halliday, and F. Morton and Co., Ltd. January 4th.
304. "Electric circuits for electric discharge devices." N. Lee, Radio Communication Co., Ltd., and J. Ree. January 4th.
313. "Charging and discharging electric storage batteries." C. E. Nightingale. January 4th.
341. "Telephone systems." Automatic Telephone Manufacting Co., Ltd. (Automatic Electric Co.). January 4th.
342. "Wireless receiving apparatus." H. M. Griss. January 4th.
350. "Starters for internal-combustion engines." K. A. Baremyi. January 4th.
351. "Starters for internal-combustion engines." K. A. Baremyi. January 4th.
353. "Steam-turbine installations." Metropolitan-Vickers Electrical Co., Ltd. January 4th.
354. "Electrical amplifying apparatus." Metropolitan-Vickers Electrical Co., Ltd., and A. E. L. Scanes. January 4th.
370. "Thermionic devices." British Thomson-Houston Co., Ltd., and J. Gray. January 4th.
371. "Electro-magnetic underground prospecting." Soc. Industrielle de Procédés W. A. Loth. January 4th. (France, January 4th, 1922.)
372. "High-frequency signalling systems." British Thomson-Houston Co., Ltd. January 4th. (United States, January 5th, 1922.)
376. "Pressure-controlled regulator for electric motors." W. A. Johnston. January 5th.
396. "Electric cooking apparatus." H. Bohle. January 5th.
401. "Induction coils." M. A. Codd. January 5th.
409. "Variometers, vario couplers, &c." W. S. Stephenson. January 5th.
410. "Flexible electric leads." J. E. S. Trelawny. January 5th.
414. "Electric circuit breakers." J. A. Cole and Humber, Ltd. January 5th.
418. "Electric lighting systems." J. E. Savidge and E. L. Terrey. January 5th.
424. "Telephone systems." Western Electric Co., Ltd. January 5th. (United States, January 5th, 1922.)
440. "Variable electric resistances." R. H. Winter. January 5th.
455. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). January 5th.
456. "Dynamometers." British Thomson-Houston Co., Ltd. (General Electric Co.). January 5th.
457. "Modulators." British Thomson-Houston Co., Ltd. January 5th. (United States, January 12th, 1922.)
459. "Resistance coils." N. Ashbridge. January 5th.
460. "Automatic, &c., telephone systems." R. Mordin and Relay Automatic Telephone Co., Ltd. January 5th.
461. "Telephone systems." B. B. Johnson and Relay Automatic Telephone Co., Ltd. January 5th.
462. "Telephone systems." B. B. Johnson and Relay Automatic Telephone Co., Ltd. January 5th.
463. "Automatic, &c., telephone systems." B. B. Johnson and Relay Automatic Telephone Co., Ltd. January 5th.
474. "Vacuum tubes." F. Péri. January 5th. (France, October 7th, 1922.)
475. "Vacuum tubes." F. Péri. January 5th. (France, October 12th, 1922.)
480. "Thermionic valve arrangements for wireless telegraphy, &c." G. Derham, J. W. Hall, and G. Tipping. January 5th.
481. "Electric arc lamps." P. Rigby. January 5th.
486. "Thermionic devices." J. Gray. January 5th.
487. "Telephone systems." J. E. Pollak (Siemens & Halske Akt. Ges.). January 5th.
489. "Sound receiver." E. T. Hincks. January 5th.
491. "Heating element for electric cooking utensils, stoves, &c." H. Bohle. January 6th.
501. "Rectifiers for battery charging from motor-car magneto." G. A. Marshall and D. Millar. January 6th.
515. "Safety switchgear." C. W. Cook. January 6th.
517. "Wireless receiving circuits." W. Diggle. January 6th.
521. "Electric signalling systems." Radio Communication Co., Ltd., and J. Scott-Taggart. January 6th.
523. "Paints and varnishes for electric insulation." W. H. Peters. January 6th.
530. "Sound-amplifying horns." J. S. Whitwell. January 6th.
533. "Electric cables." F. Fernie. January 6th.
548. "Insulating cap or hood for wireless aerial, &c., circuits." J. Y. Brown. January 6th.
551. "Electric switches." Ferranti, Ltd., and A. W. G. Tucker. January 6th.
558. "Electric switch." A. Linard. January 6th.
562. "Electric heaters." J. Vigneault. January 6th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

16,909. "Control of trains." A. R. Angus. June 20th, 1921. (190,503.)
17,366. "Wireless receivers." R. B. Ransford (Soc. Française Radio-Electrique). June 24th, 1921. (190,505.)
21,052. "Electrical and magnetic treatment of plants and animals." N. Mancini. August 8th, 1921. (190,512.)
24,692. "Dynamo-electric machines." Lancashire Dynamo and Motor Co., Ltd., and H. B. Whitmore. September 17th, 1921. (190,531.)
25,077. "Inductance coils." J. P. Prangnell. September 21st, 1921. (190,532.)
25,295. "Electric transformers." British Power Railway Signal Co., Ltd., H. Tinsley, and D. C. Gall. September 23rd, 1921. (190,542.)
25,685. "Charging stations for electro-automobiles and other locomotive accumulator batteries." A. Bjerke. September 28th, 1921. (190,554.)
26,945. "Electric switches." C. Pasteur. October 12th, 1920. (170,289.)
27,407. "Means for producing high-frequency electric vibrations or oscillations, more particularly for transmitting messages." W. E. E. Habann. October 15th, 1921. (190,577.)
27,617. "Method and apparatus for measuring resistances and magnitudes of which the measurement can be reduced to the measurement of a resistance." M. Coppee. October 18th, 1921. (190,581.)
29,310. "Means for varying the intensity of illumination of road-vehicle electric lamps." J. H. Runbaken and W. Torrance. November 3rd, 1921. (Cognate application, 32,499/21.) (190,596.)
29,579. "Commutators or distributors for use in electric ignition systems." A. H. Caley and P. S. Talbot. November 7th, 1921. (190,597.)
29,733 "Electric motors for dental engines or like purposes." C. A. King. November 8th, 1921. (190,599.)
29,922. "Advertising and displaying apparatus, moving and changing." F. H. Neate. November 10th, 1921. (190,603.)
29,989. "Insulating elements." British Thomson-Houston Co., Ltd. (General Electric Co.). November 10th, 1921. (190,604.)
31,080. "Instruments for measuring or indicating the wattless component of alternating currents." Chamberlain & Hookham, Ltd., and S. James. November 21st, 1921. (190,613.)
31,252. "Electric starters for internal-combustion engines." R. Haddan (F. Neumeyer Akt. Ges.). November 22nd, 1921. (Addition to 152,355.) (190,616.)
31,387. "Means for coupling alternating-current generators in parallel." N. E. G. Meijer. November 23rd, 1921. (190,619.)

1922.

1,766. "Calorimeters." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). January 20th, 1922. (190,650.)
1,790. "Systems for producing oscillating currents." British Thomson-Houston Co., Ltd. May 18th, 1921. (180,295.)
2,352. "Telephone transmitters." E. W. Pattison (Dictograph Products Corporation). January 26th, 1922. (190,655.)
2,515. "Pyrometers." British Thomson-Houston Co., Ltd. (General Electric Co.). January 27th, 1922. (190,657.)
2,560. "Incandescent electric lamps." General Electric Co., Ltd. February 4th, 1921. (174,929.)
15,059. "Speed-controlling devices for railway, tramway, and similar trains." E. Rodolausse. May 28th, 1921. (Addition to 162,617.). (180,698.)
16,302. "Lighting plants of motor vehicles." Scintilla. June 13th, 1921. (181,390.)
22,443. "Lamp for curative purposes." F. Forbes. August 17th, 1922. (190,687.)
26,096. "Control of trains." A. R. Angus. June 20th, 1921. (Divided application on 190,503.) (190,689.)
31,615. "Control of trains." A. R. Angus. June 20th, 1921. (Divided application on 190,503.) (190,690.)

Another Inquisitive Rat.—A further addition to the tale of rats which have caused trouble in power stations was recently reported from Belfast. On this occasion the rodent got into a high-pressure cubicle causing a "short" which deprived the city of light and stopped the tramway services.